INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

[ONTHLY BULLETIN
F AGRICULTURAL INTELLIGENCE
AND PLANT DISEASES

AR V - NUMBER 4 APRIL 1914

* * ROME: PRINTING OFFICE OF THE INSTITUTE. 1914. * * * *

In quoting articles, please mention this BULLETIN.

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FIRST PART.

ORIGINAL ARTICLES

Present State of Plant Breeding in Denmark

by

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The improvement of agricultural plants in Denmark is a recent depar-
. In reality it is only at the beginning of this century that real progress
iis direction has been made and a definite plan has been followed. Be-
this time the only really successful work was that carried out by ERHARD
DERIKSEN, who, under the influence of the work and progress achieved
ermany, introduced similar operations into this country. Frederiksen
loyed also the methods adopted by the best German breeders of
period : Beseler, Bestehorn, and Rimpau.

The best known varieties that he bred were the following :

Forage sugar beets, a cross between sugar beets and mangolds ; *hybrid*
ys, crosses between Imperial (*erectum*) and Chevalier (*mutans*), and
y *Normal Squarehead wheat*. The latter was produced by ear selection
i the older Scotch Squarehead introduced in 1874, which, in the course of
s, inclined to degenerate. The method adopted was the one usual
ther countries : Ear selection of the best types and breeding mixtures
he same. At present the above varieties are not much grown. The
mal Squarehead attained considerable importance, not only in Den-
k but also in Sweden and Germany, where it served as a basis for the
her work of improvement undertaken by Strube and Heine.

In considering present work and its results, it appears advisable to take
i group of plants by itself.

Root crops. — Without considering sugar beets, which have not been
ected to improvement in Denmark, and the seeds of which are not pro-
ed in the country, the various kinds of mangolds have been the subject
nergetic efforts at improvement by the many private seedsmen of the
ıtry.

Among mangolds, the Barres mangolds, of French origin, have been most successfully improved as to uniformity, yield and production of dry matter. The method adopted, which, with the exception of slight modifications according to the species, is the same for all root crops, may be briefly described as follows:

The selection of the seed mangolds is made from the common stock. The finest mangolds are selected in large numbers and, with the object of provisional selection, often submitted to a direct test as to specific gravity, using a solution of salt of suitable strength. The heaviest mangolds are selected and with each of them the specific gravity of the juice is determined by means of an areometer. Some of the best breeders proceed further to the direct determination of the dry matter of the individual mangolds in samples bored out of the roots, and then set aside separately the most promising specimens. These are then enclosed, either singly or in pairs in linen cloth bags until the flowering time is over. The seeds of the individual mangolds are sown in one or more small plots. The process is repeated with the offspring of the best lines.

Among the mangolds thus improved, those that deserve to be mentioned as the best are the Sludstrup, Rosted and Taaröje varieties, which have proved in the course of extensive experiments instituted by the State to be far superior to all foreign varieties in the production of dry matter per unit area. Similar results have been obtained with kohlrabi, turnips and carrots.

The exhaustive experiments carried out in the State Experiment Stations with the object of determining the value of the various root crops are placed under the management of L. HELWEG, of Copenhagen, director of the experiments. These experiments are of decisive importance both for the improvers and for the farmers, who would otherwise be seriously embarassed in the choice of the variety to grow. If the experiments were not conducted as they are, advertisements would be the only guide, while these experiments provide a decisive and impartial verdict on the results of the work of improvement. At intervals of a few years the results obtained in the State experiments are published in the "Tidsskrift for Landbrugets Planteavl" (Journal of Agricultural Plant Breeding), which appears in four parts every year, and discusses all the results of the experimental work of the State in Denmark.

Cereals. — As has been said above, but little was accomplished in this field previous to the year 1899-1900. At any rate, with the exception of Erhard Frederiksen's work, the results of practical importance have been obtained after that date. The work then began to proceed much more rapidly, partly owing to the new and more promising principles of plant improvement. Especially the discovery of breeding in lines attracted more breeders into the field. The first results of Svalöf in Sweden and the work of the Danish Professor JOHANNSEN, which proved that the type remained unchanged generation after generation in the individual lines of autogamous plants, contributed to awaken hopes which in reality did not lead to disappointment.

Up to the year 1899-1900 almost all breeders practised mass selection, t is selection of promising individuals or ears followed by breeding mix- es of this so-called " Elite ". The demand for this Elite was gradually ed, but on the whole the practical results were not great, and often n negative. Attention was continually directed too much to the *viduals* instead of to their *offspring*. It happened and still happens t the largest and apparently strongest plants by no means give the best pring; on the contrary the more modest-looking plants often pro- e the best progeny. In this connexion there could be no clear un- standing so long as the *importance of heredity was not duly recognized.* a mixture the more modest forms are often — literally as well as meta- rically — overshadowed by the finest individuals; the latter however, pure cultures, prove often inferior to the pure cultures of the progeny less handsome individuals.

For a long time after the cultivation of the offspring of single indivi- als had been begun, it was rather difficult to understand the matter fully, withstanding the fact that striking proofs could be afforded that it s the right method to pursue. A critical examination of those varie- s which, in the course of years, had been tried and then abandoned in vour of more productive ones, showed that as a rule the less good look- g varieties were the best. The most esteemed about 1900 were: Square- ad wheat, Brattingborg rye, Danish (Provsti) oats and Prentice barley. l these varieties were, after the exhaustive experiments undertaken by Nielsen and, later, by the Malting Barley and Wheat Committee, recog- ed as the best for Danish conditions; yet none of them could compete appearance in the field, and on a rapid valuation of superficial conditions growth, with a whole series of varieties which in reality were inferior in ld and quality. In one or more points the latter failed to meet the de- nds which are made in this country as to resistance to cold, strength haulm, resistance to diseases of various kinds and yield of grain. The ter property depends upon so many factors that there are always but w varieties that possess the fortunate combination of all these privileges any high degree.

About the year 1900 the following breeders were at work (partly on the ove-mentioned lines of individual plants and their offspring): K. HANSEN, ngby Experiment Station; K. JØRGENSEN, Lyngby; N. P. NIELSEN, stofte; H. A. B. VESTERGAARD, Naesgaard (later Abed). The three ter worked almost exclusively with " pure lines ". The first results of ese labours appeared in the years 1906-08 in a series of varieties of oats, rley and wheat (winter wheat). The following showed themselves, in merous experiments, decidedly superior to the older varieties. Tystofte entice barley, Abed Prentice barley, Yellow-white Tystofte oats, llow Näsgaard oats, Tystofte Small wheat, Tystofte Stand-up wheat d Abed Large-eared wheat. The barleys are two-rowed and bent- ed. From six-rowed barley, Tystofte Hybrid barley has been bred.

Within the next few years several varieties will appear, among others ed Binder barley.

At Lyngby some new varieties of winter barleys have lately been pro
duced. In rye no novelties have been developed. The above-mentioned Bra
tinborg rye and the well-known German Petkus rye are generallly grow
and it will probably be some years before any new Danish-bred ryes appea

The method adopted will be briefly described. The foundation is
all the above cases the individual plant. In its details the method varie
first the variety is selected from which a line is to be bred ; this is frequentl
one of the so-called country varieties, which includes several individu
types. We can assume that a hundred such have been chosen; the nex
year fifty grains from each are laid, grain by grain, in furrows or holes i
parallel lines ; the growing plants are observed and all their various prope
ties which can be of importance in practice are described. Each line
harvested by itself ; the quantities of grain and of straw are examined, an
the thirty most promising lines are used for experiments plots on a sma
scale in the following year. The plots are two, each of 4 or 5 square yar
in extent. In this year also the young plants are carefully observed
the field ; those with the weakest straw, as well as those inclined to
sease, are eliminated. Only the eight or ten that yield the best resul
are kept for further experiments. The experiment in the third year a
more comprehensive and are undertaken in a way to ensure greater re
liance upon the results, for three or four parallel experiments are made o
plots measuring 12 or 24 square yards. If all conditions have been favou
able, the result of this experiment can be used for the further eliminatio
of the least valuable novelties, and only two or three varieties are kep
The experiment is continued in the fourth year as in the third, and if
untoward circumstance arises according to the result of this year, in th
fifth year the multiplication of the most productive variety on a large sca
in the fields can be contemplated. But it seldom happens that one ca
foresee with sufficient certainty that the selected variety is really so muc
better than the best hitherto known, and in order to ascertain this, still a fe
more years must be devoted to experiments. For this experiment a goo
opportunity is offered by the two years which are generally required t
bring the small quantity from the experiment plot to saleable quantities
In Denmark the State contributes also to the final decision of the questio
whether the new variety deserves to be put into general use or not, inasmuch
as every variety of importance is tried in the Experiment Stations.

There is, besides, the local travelling experimental work conducte
by the individual agricultural organizations. The experiments are under
taken by farmers under its supervision, so that the varieties ar
brought under varying conditions, and in every case they are compared wit
the best varieties of the same kind known at the time. When a new va
riety has satisfactorily stood these tests, as a rule it soon gets the rapi
diffusion that it deserves, since the farmers are often acquainted with th
results of the experiments before the variety is put upon the market. Th
offers of sale are made either by the State or by the agricultural organ
izations.

In the Experiment Stations where many varieties are compared,

plots are used for every variety. In local experiments with only two ree varieties 10 or 12 plots are used so as to ensure reliable results.

The publication of the results of the travelling experiments is made once r in the written (and verbal) reports of the Agricultural Federations ch of the four parts of the country: Jutland, Fünen, Seeland and Lol-Falster.

The reports of the State Experiment Stations appear at longer intervals, racing from 4 to 8 years. The results are thus based on the ex-nents of several years. Thus the two kinds of experimental work com-each other, in this as in many other fields, for the solution of the ms questions.

The Chairman of the State Plant Breeding Committee is Professor ESTERMANN of Copenhagen.

Some of the recent results obtained in the State Experiment Stations varieties and breeds of agricultural plants are mentioned below, as present a more than local interest.

Experiments were made with *wheats* at Tystofte and Abed from 1907 12. The greatest yields were given throughout by Wilhelmina Small t, Stand-up wheat and Large-eared wheat, which yielded from 58 to shels per acre. The three latter are Danish varieties of recent origin; f them, but especially the Stand-up wheat, are more resistant ld than Wilhelmina. Altogether 20 varieties were tested, including 4 Svalöf, 2 from Germany (Strube's Stockweizen No. 56 and Strube's rehead) and 2 from England (Stand-up and Original Squarehead). worst yielding varieties gave, under the same conditions as the e-mentioned ones, 35 to 49 bushels per acre.

With *oats*, experiments have been conducted during a small number ears at six Experiment Stations. Out of 15 varieties tested, the fol-ng yielded the best results, with 84 to 87 bushels (of 42 lbs.) per acre: ow Näsgaard, Stern, Schlanstedt and Yellow-white Tystofte. The two gave the best results on both loamy and sandy soil. Among the less luctive were the following well-known varieties: Ligowo, Goldregen and lewitz. With the exception of Schlanstedt, the first group are all of Danish in. The varieties that yielded least gave 8 to 12 bushels per acre than the best.

Before the new varieties appeared, a great number of foreign varieties tested, but all of them, with the exception of Schlanstedt and rican Banner oats, yielded light crops.

With *barley* both the Agricultural Associations and the State Stations conducted experiments for a series of years. The most productive eties were Tystofte Prentice, Abed Prentice and Svalöf Princess. All e varieties sprang from the Prentice barley introduced in 1884, which, as known later, was called Archer barley in its home (? Ireland). Of other varieties grown, the following are to be mentioned: Svalöf Hann-, Hanna, Goldthorpe, Imperial, Juwel, Stand-well, Chevalier. None hese, however, could compete throughout with pure-bred Prentice s. The chief defects of Prentice barley are that it ripens late and

that the strength of the straw leaves something to the desired. Of la years all efforts have been directed towards producing an earlier varie with stronger straw.

Abed Binder barley appears, anyhow, to possess these last two q quisites, but has not yet been tested enough under various conditions to its productiveness. The variety is therefore not yet sent out f practical purposes.

Grasses and clovers. — Work with these, as with cereals, is compara ively recent and the nature of the work is such that it takes longer to rea decisive results with these plants than with the annual cereals. The is also the circumstance that most of them are allogamous, which rende constancy more difficult or impossible to attain.

The Experiment Station at Tystofte, whose Director is E. LINDHAR deals especially with the improvement of these plants. A new improv ryegrass has been sent out this year from Tystofte. At Lyngby and Ab also, work is conducted on some kinds of forage plants.

The work at Tystofte is very extensive, especial attention being pa to isolating the individual forms, as well as to reliable control with t parent form in order to obtain the greatest possible constancy. Ma hundreds of plants are enclosed in bags and harvested separately. T multiplication of elite plants is practised on a large scale. In order ensure the pollination of red clover, nests of humble bees are enclosed w the clover elite in large linen tents. In this direction a great deal of wo is done, but it will require five or six years more before judgment c be pronounced on the results.

The Cultivation of Sugar Cane in the Argentine Republic

by

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Historical notice. — Among the industrial plants grown in the Arge tine Republic only two have acquired much importance : the vine and th sugar cane.

The latter was introduced into America by the Spaniards short after the conquest, and it spread immediately into the West Indies, Ce tral America, Peru, Brazil and the northern part of Argentina. The fir trustworthy evidence of the cultivation of sugar cane in this count dates back to the beginning of the seventeenth century and refers, as appears from the archives, to a plantation which existed in the distri of Chicligasta, province of Tucuman. However, before the Jesuits esta lished themselves in this province in 1670 and founded a convent whi still exists at Sules, no one had manufactured sugar in the country a the canes were only used for sucking.

In 1767 the Jesuits were expelled from Argentina, the manufacture of ır ceased and the cultivation of sugar cane was kept up only on very ted areas. Up to the middle of the nineteenth century all the sugar sumed in the Argentine Republic came from abroad. For 54 years after expulsion of the Jesuits, no one, as far as is known, made sugar, no doubt ause no one was acquainted with the industrial treatment of the cane. 821 Dr. José Eusebio Colombres, a Tucuman priest who also played an ortant part in the political organization of the Republic, made a suc- ful attempt to restart the sugar cane industry. At first only molas- were made. The results obtained by Dr. Colombres induced others ollow his example, and gradually rudimentary factories sprang up, irst satisfying the demands of the Tucuman market and later those of neighbouring provinces.

It will easily be understood that as Tucuman is upwards of 600 s from the nearest port, the first factories were very primitive, and the sugar they produced did not reach the distant coast district, ch at that time was the most populated and almost the only one ing a civilized population that consumed sugar. In 1834, notwith- ding the short time that had elapsed since Dr. Colombres' initiative, local Government dared to impose a tax of one peso per arroba ut 2 pence per lb). A few years later 24 small factories were at work. 860, without any other means of transporting heavy modern ma- ery than the traditional Tucuman bullock-cart, a bold attempt at rovement was made, which proved economically disastrous to its ori- tor, Balthasar Aguirre, but must be mentioned because it had an ence on the subsequent improvement of the sugar industry.

Area under sugar cane. — The national statistics of 1911 return area under sugar cane in the whole Republic at 230 770 acres, which 210 000 are in the province of Tucuman; it must not be otten, however, that Argentine statistics cannot be very exact, he country is not yet fully organized and of enormous extent, and institutions are still, in some respects, rudimentary. The general istics to the end of 1913 are not yet published. The provincial sta- ics recently completed show that the province of Tucuman alone had January 1, 1913, 220 000 acres under sugar cane.

As the cane plantations in the other provinces and territories extend slowly, the acreage grown to canes in the whole Republic may be safely mated at 250 000 acres.

The above data on the cultivation and on the utilization of the su- cane refer almost exclusively to the province of Tucuman, which, t is a very important economic and social centre, is destined to keep many years its present supremacy in this industry, notwithstanding existenc of other districts in Argentina equally and perhaps even e suitable for this crop.

Soil. — As sugar cane is grown over a wide area it occupies soils of erent kinds; they may be divided into two groups:

a) Loams, which contain up to 90 per cent. of clay, most of it be very fine. In general, growing sugar cane on such soils is not possi without the aid of irrigation.

b) Humous sands which have been recently cleared of forests, are situated on the slopes of forest-clad mountains, and where the c can be grown without irrigation, as the soil is fairly moist, especially wh it has been under cultivation for only a few years.

The chemical composition of most of the soils does not vary mu there is scarcity of lime, which rarely reaches 1 per cent., and an abunda of potash, of which these soils contain from 4 to 6 per 1000; they hav normal quantity of phosphoric acid, that is upwards of 1 per 1000, and nitrogen, also about 1 per 1000.

Owing to the relatively recent introduction of this plant, to the de of the arable layer and to economical reasons, the use of artificials has yet become general.

Climate. — In the district of the province of Tucuman in which su cane is grown, and which lies between the parallels of 26° and 28° S, the mate is subtropical, but tempered by the vicinity of the high range of Ac quija on the west. These mountains are at the same time the princ cause of the rain which benefits local agriculture, rendering Tucuma region of abundant moisture surrounded by completely arid belts in wh no rain falls.

Meteorological observations carried on for many years exist only for city of Tucuman, to which the data here given refer. They are there not strictly accurate for all the sugar cane area. The average rainfal the last decade was 965 mm. (37.98 inches); the maximum during this riod was 1308.3 mm. (51.51 in.), the minimum 739 mm. (29.09 in.). At the of the mountains, where most of the non-irrigated cane-fields are situa the rainfall is considerably higher than the above average. The ave mean temperature of 45 years is 19.28° C. (66.7° F.), the average hig 44.4° C. (112° F.), the average lowest 3.2° C. (37.8° F.). In the last de 90 temperature readings were below 0° C. (32° F.) in the months of J to August, chiefly in June; and 6 readings above 40° C. (104° F.) in Novem December and February. The influence of the wind on the temperatu great; south-easterly winds lower it by 1.9° C. (3.4° F.), northerly w by 2.4° C. (4.3° F.); southerly winds raise the temperature by 1.8° C. (3.2° while those from the west lower it by the same amount. The winds moderate and not frequent, and therefore do not cause lodging of the can

Varieties. — The greater portion of the area is under two varieties cane which were introduced many years ago: the brown *Morada* varie which is the prevailing one, and the striped or *Rayada*, next in importan Both are considered local varieties (*criollas*), because they have acqui special characters which do not allow the original variety from which th are derived to be recognized.

For some years past attention has been turned to the cultivation varieties introduced from other countries. The initiative of these exp ments, at present in full swing, belongs to the "Escuela Nacional de Agric

y Sacarotécnia " of Tucuman, which in 1907 introduced 70 varieties. resent this institute possesses a collection of upwards of 250 groups of ties, many of which have been studied from a technical point of view ig the last few years. Though at present insufficient experience been gained in this connection, it may be affirmed that the research rto carried out leads to the belief that, as in other countries, ill soon be found advantageous to replace to a great extent, t totally, the varieties hitherto grown by some of those recently ntroduced. It is beyond discussion that the initiative of the Escuela gricultura y Sacarotécnia has raised much interest among the planters, of whom have already provided themselves with the new seeds in to test them, and thus cooperate efficiently with the official work.

The cultivation of sugar cane in the Argentine Republic will soon cease based only on colonial practice and tradition, and will be founded, as in other countries, on a scientific basis which will ensure an increased n improved production of sugar.

As it is not possible to set forth in detail all the experiments that have hitherto carried out, we shall limit ourselves to a summary of the experi- s conducted in 1913 on some varieties of cane at the Agricultural Sta- attached to the Escuela Nacional de Agricultura y Sacarotécnia.

Form and duration of the plantations. — In the Argentine cane fields one system of planting is followed : in the bottom of the furrow 10 inches deep the cane cuttings, each with three or four eyes, are placed continuous series. The rows are 6ft to 6ft. 8 in. apart The plantation ewed every 6 or 7 years according to the quality of the soil. There are, ver, plantations in which the canes are harvested without interrup- or 10,12 and even 15 years. The first year after planting, the canes s give a crop inferior in quality and in quantity to that obtained from anes originating from ratoons, the explanation being the shorter pe- f vegetation of the former. Plantations made in September or October ropped in June or July of the following year, that is at 9 or 10 hs old.

igation. — Barely one-third of the acreage under canes in Tucuman ificially irrigated. Owing to the abundance of rain from October to the canes, even without irrigation, yield remunerative crops under ng economic conditions. It is undeniable that in many cases the could be increased by means of irrigation, but for this it would be sary to carry out important irrigation works, some of which have been ed during recent years. But even in the localities where irrigation is available it is quite exceptional to find estates which irrigate matically and drain in a suitable manner ; thus it is not rare to rrigation more injurious than benefical. The time in which irriga- s practised is from October to February.

The work of cultivating does not last more than 6 or 7 months. The n irrigation at present in vigour allows 25.7 cub. feet of water per per hour permanently, without taking into consideration the class of

crop. But only rarely is this quantity actually obtained, as the canals not convey the necessary supplies.

Form of agricultural agreement for the cultivation of sugar cane. — Argentina the sugar cane is grown under three forms of labour c tract: 1) the plantations are managed directly by the owner himself by an agent with the help of hired labour; 2) they are worked on the sh system by a "contratista"; 3) they are rented. The first is the least freque as there are but few large proprietors who reside on their estates and n nage them personally. This form, however, yields the largest profits, acre of cane plantation yielding as much as £7 to £10 per annum.

The contratista gets by contract a certain number of rows of canes e 330 feet long; the sugar factory or the owner of the plantation supplies him a rate of interest agreed upon, with the necessary funds for all the farm operations, and at harvest time purchases the canes from him a price which has been previously agreed upon between the parties, or wh is fixed from year to year upon the basis of the current prices of sug The usual price is from 12*s* 3*d* to 14*s* per ton of cane delivered at the su factory; assuming the produce to be about 10 tons per acre, which is average yield, the grower gets £1 15*s* to £2 10*s* per acre net profit. Of cou in bad years his profits are much less. This is the most common agreeme and usually lasts 2 to 5 years.

Farmers who rent the land are very few; the rent is 4*s* 3*d* to 5*s* 8*d* acre. The tenant plants and grows the canes on his own account, l almost always has a contract for the sale of the canes to a factory at a pr proportional to that of the sugar.

Yield. — The old farmers of the province of Tucuman, who h grown cane for the last 20 or 30 years, maintain that the productivity the striped and brown varieties has diminished considerably; almost attribute this falling off to the exhaustion of the land, which has alw been put to canes without manures or rotation. Though our observati during four consecutive years do not allow us to determine complet the cause of the diminished yield, this decrease is evident in many l lities, if not in all.

In the Experimental Station attached in 1913 to the Escuela Nacio de Agricultura, a series of soil analyses has been undertaken, beginning w those soils which have been longest under this crop, and continuing w those on which it has been introduced later. Although the data hith collected are not complete, they point already to the fact that the decreas production is not only due to the exhaustion of the soil, but also and ma to lack of care in the selection of the cuttings employed for replanting cane fields, as well as to imperfect cultivation.

Until lately, owing to mistaken economy, it was the general cus in making a plantation to use the tops, that is just that part of the can which the eyes are least developed. It is true that in other countries tops are used for this purpose, but they are countries with a more tropical mate, in which the vegetation of the canes lasts as much as 20 months, wh in Tucuman the canes are for the most part harvested after 10 to 14 mon

les, as the time of planting coincides with the dry season, the tops have re difficult start. If to this be added that in all kinds of soil only su- ial ploughing is practised, reaching at most to 8 inches in depth, it e readily understood that the yield has diminished even without the eing exhausted. Some owners are trying deep ploughing by means am ploughs with success.

The average yields per acre are at present as follows :

	tons
Bad years.	6 ½ to 8
Normal years	9 to 10 ½
Good years.	11 to 14
Very good years	16 to 20

The cost of production of one ton of canes is from 8*s* 9*d* to 12*s* 6*d*. The rice varies from 19*s* 6*d* to 25*s*.

Causes of injuries to the canes. — In some years the canes suffer consid- r from unfavourable weather, but so far they have no serious pests to nd with. Among vegetable parasites there is only "polvillo" (*Bacil- cchari*), which attacks the leaves and arrests the development and ng of the canes. The parasite does not always appear with the same sity; it attacks all the varieties cultivated in the province, but not the same frequency or gravity.

Among insects, the borer or "perforador" (*Diatraea saccharalis*) s considerable injury in those years favourable to its multiplication. r insects which are at present being studied are also injurious, but the ief they do is not very important.

Progress of the industry. — There are at present 38 sugar factories in ntina, 28 of them being in the province of Tucuman and the others in rovinces of Salta, Jujuy and Santa Fé and in the national territories e Chaco and Formosa.

The sugar industry has progressed more rapidly than the cultivation e canes. The old and modest factories of past years, equipped with en presses worked by hand or gins, have disappeared before the modern ries, almost all of which are provided with up-to-date machinery and ed according to the most approved methods. Of late years triple press- ith double saturation and the use of the Krajewski mill have become al. For the evaporation of the liquids, triple and quadruple concentra- pparatus is commonly used, as well as recrystallizers and continued ation.

Owing to the improvement of the factories, the yield of the canes rom 3 per cent. in 1870 to 5 per cent. in 1881, and to the following s taken from the official statistical returns :

	Variety	Weight of canes per acre — lbs	Average weight of a cane — lbs	Number of canes per ton	Le — Average — inches
4	Native Rayada	65 384	2.50	893	54
6	Native Morada	64 046	2.35	951	58
14	Poudre blanche	70 156	2.16	1 035	54
15	Roxa	57 757	2.13	1 049	52
18	Kavangire	94 362	1.39	1 604	69
19	Rayada from Brazil	47 900	1.55	1 445	50
26	Bois Rouge	55 482	2.04	1 093	46
36	D. Gaetano	68 327	3.86	573	71
46	Reine	57 712	2.10	1 066	47
48	Rose cayana	56 594	2.74	816	52
50	Green from the Antilles	53 921	2.40	931	55
55	Sin nombre 55	54 100	2.38	939	62
58	» » 58	59 095	2.20	1 014	58
62	» » 62	43 084	1.96	1 141	54
64	» » 64	71 583	3.48	643	65
74	Riscada de Santa Barbara	59 496	2.82	792	63
75	Mantelga de Santa Barbara	76 489	3.52	634	67
76	Java 234, ratoons	49 238	1.74	1 284	65
77	Sin nombre 77	114 622	1.32	1 691	69
79	Java 228, plant canes	64 090	2.10	1 066	57
	» ratoons	69 576	—	—	—
80	» 139 plant canes	48 123	1.58	1 418	60
	» ratoons	45 893	—	—	—
81	» 38 plant canes	81 350	2.45	912	72
	» ratoons	108 021	—	—	—
82	» 213 plant canes	56 241	1.58	1 411	47
	» ratoons	92 723	—	—	—
83	Barbara 228 plant canes	34 208	2.21	1 013	35

es	Minimum — inches	Extraction	Analysis of juice: Brix %	Saccharose %	Purity	Reduction %	Reduction % saccharose	Saccharose extracted from 100 lbs of cane — lbs	Saccharose extracted per acre — lbs	Comparative value of cane	Classification according to comparative value
3	0.63	65.1	16.44	14.08	85.6	0.31	2.2	9.152	5 984	61.2	11
1	0.55	62.8	17.61	15.42	87.5	0.21	1.3	9.684	6 202	64.8	9
4	0.75	63.0	17.10	14.38	84.1	0.64	4.4	9.059	6 356	63.8	10
4	0.79	61.4	16.22	13.58	83.7	0.53	3.9	8.338	4 816	48.1	20
4	0.43	60.3	16.68	13.60	81.5	0.28	2.0	8.241	8 024	78.1	5
2	0.67	61.2	14.63	11.35	77.6	0.28	2.4	6.945	3 327	30.8	28
8	0.83	62.3	16.67	14.18	85.0	0.35	2.4	8.834	4 902	49.8	19
1	0.87	67.9	17.39	14.80	85.1	0.55	3.7	10.049	6 866	69.8	7
8	0.79	61.5	16.63	14.41	86.5	0.30	2.1	8.662	5 115	53.0	16
5	0.79	64.0	16.10	14.15	87.8	0.30	2.1	9.055	5 125	53.7	14
8	0.87	63.3	16.30	13.70	84.0	0.40	2.9	8.672	4 676	46.2	21
5	0.67	64.7	17.05	14.93	87.5	0.31	2.1	9.660	5 226	54.6	12
7	0.71	63.5	16.83	14.31	85.0	0.36	2.5	9.087	5 370	54.5	13
5	0.43	60.0	17.81	15.54	87.2	0.23	1.4	9.324	4 017	41.8	26
1	0.63	65.5	18.25	15.79	86.5	0.47	2.9	10.279	7 564	78.2	4
4	0.59	61.6	16.51	14.18	85.9	0.28	1.9	8.735	5 197	53.3	15
3	0.87	66.0	15.39	11.62	75.5	0.92	7.9	7.669	5 866	52.9	17
2	0.63	55.6	18.12	16.11	88.8	0.08	0.5	8.957	4 410	46.8	22
)	0.43	57.3	17.28	14.44	83.5	0.27	1.8	8.274	9 484	94.6	3
5	0.79	64.5	15.95	12.95	81.2	0.36	2.8	8.353	5 354	51.9	18
·	—	60.5	18.81	16.01	85.1	—	—	9.686	6 739	68.5	8
)	0.59	57.0	18.35	15.13	82.4	0.34	2.2	8.624	4 385	43.2	24
	—	57.9	19.55	16.19	82.8	—	—	9.374	4 302	42.5	25
)	0.59	61.1	16.87	14.21	84.2	—	—	8.682	7 062	71.5	6
	—	58.8	18.85	15.76	83.5	—	—	9.267	10 010	100.0	1
)	0.63	61.3	15.58	13.25	85.0	0.15	1.1	8.122	4 568	46.4	23
	—	57.5	19.38	17.38	89.5	—	—	9.993	9 266	99.2	2
)	0.79	62.4	17.07	14.69	86.5	0.18	1.2	9.167	3 135	32.4	27

Years	%	Years	%
1903	7.56	1909	6.21
1904	8.07	1910	7.68
1905	7.49	1911	6.37
1906	6.14	1912	6.58
1907	6.52	1913 up to Oct. 31 .	8.03
1908	8.21		

In 1913 the most modern mills had an average yield above 9.5 per cen

The further improvement of the methods of sugar-making will henc forward be assisted by the small sugar factory (capable of crushing 30 to of canes per day) which, in June 1914, will begin to work at the Escu Nacional de Agricultura y Sacarotécnia, and which is devoted to expe ments, to objective teaching and to the instruction of capable experts.

Up to the present about £ 14 000 000 are invested in the sugar indust in the Argentine.

Foreign refined sugar pays at present a customs duty of $1^3/_4 d$ per l which according to the provisions of law No. 8877 of February 8, 191 will be gradually lowered to 1 ½ *d* per lb. in 1921.

At present only four sugar refineries exist in the Argentine; two them are very important and others will soon be erected.

Recent Work of the Royal Hungarian Station of Biology and Animal Nutrition

by

Dr. István Weiser,

Chemist in Chief, and Professor at the Budapest Royal Veterinary College.

Of late years the Station has conducted research work of general int est connected mainly with the composition of the fodders produced in Hu gary and their nutritive value, as well as upon animal metabolism, especia in pigs.

The Station has made exhaustive investigations into the problem metabolism in these animals, on account of its theoretical and practi importance and also because it has been less studied than in cattle a horses. In order to reach reliable results, the metabolism in fasting p and the energy required for their maintenance must be known exactly.

With the aid of a respiratory apparatus, constructed for the purpo the total quantity of water and of carbonic acid expired by the animal w determined; in the same way the animals under experiment could be o served at temperatures ranging from 5° C. to 30° C. The first research was determine the minimum amount of energy required by the pig at rest a fasting. This amount depends in the first place upon the surrounding te perature and reaches its minimum at the so-called critical temperatu

hich the oxidation processes in the animal organism are at their lowest. experiments, made on two young pigs weighing 101.2 and 114.4 lbs., and adult pigs weighing 250.8 and 279.4 lbs., have shown that, during ing, the transformation of energy in the growing pig not fattened is st at a temperature of from 20° to 23° C. (68° to 73.4°F.), which is the ical temperature of the unfattened pig. In the fattening pig the critical perature is probably lower, about 17° C. (62.6°F). The transformation of gy observed at the critical temperature is the minimum functional k of the pig, which, in the fattened animal (about 220 lbs.), is 8.91 cas per pound weight of the body and 98.5 calories per square foot of y-surface, while in the unfattened animal (about 110 lbs.) it is 12.36 cas per pound weight of the body and 102.2 calories per square foot of body ace. It follows that the minimum functional work calculated per of body-surface is independent of the fat in the animal.

Our recent experiments have the object of determining the requirements nergy in pigs.

We have recently experimented upon dried pomace, one of the fod- of the country. In Hungary the majority of distillers dry their pomace pletely; only one distillery presses it before drying it, thus drying only olid parts. We have compared these two kinds of pomace. Their comtion varies very much, the variation being rendered more marked by fact that the distilleries add carbonate of lime in varying quantities to completely dry pomace. The pressed pomace contains less amides the unpressed samples. In the latter the sum of fat and crude protein nerally between 39 and 44 per cent., and in the former between 44 and er cent. The nutritive matters of pressed pomace are not so digestible ose of the entirely dried pomace, with the exception of protein, which ually digestible in the two. The lower digestibility of pressed pomace e to the elimination of the more digestible parts by pressing. ppears, by comparing the fresh and pressed pomace from the source, that desiccation has no effect on the composition of the dry er or on the properties of the fatty matter; on the other hand it dishes considerably the digestibility of the crude and true protein. d pomace and, in a greater measure, fresh pomace caused a consible fixing of nitrogen in cattle, that is to say they favoured the foron of flesh.

The experiments made with pomace assisted also in determining in manner the dry and fresh material act on the production and compo- of milk. Experiments made with two cows showed that the same tity of dry matter fed either fresh or dry has the same effect on the tity of milk, provided the requirements of the cows as to protein and y be satisfied in both cases. When we fed fresh pomace in excess of the sary food, only a very small part of the excess produced any noticeeffect on the animal organism and on the yield of milk. The itution of dry pomace by fresh pomace containing the same quanf dry matter did not in any way modify the content of dry matter at, or the specific gravity of the milk, or the index of refraction of the

milk serum. The substitution of fine wheat bran for dried po diminished the amount of milk yielded by the two cows under experim While the amount of fat in the milk of one cow did not change at all, in other it increased a little.

The iodine number of the butter fat in the milk of the cow fed wheat bran was lower than that of the one fed on dry or fresh m pomace. After having been fed on fresh pomace, the iodine numbe the butter fat was higher than when the animals consumed the s amount of dry matter under the form of pomace.

During recent years we have devoted much attention to maize for der, as this is one of the most important fodder plants of Hungary. generally sown in rows 6 to 8 inches apart; but for late sowing or in soils the distance between the rows is increased to 12 inches. This sys is followed both for the maize to be fed green and for that to be ensila For the latter, of late, distances of from 20 to 28 inches have been propo

In order to ascertain the influence of these distances between the r on the yield and nutritive value of the fodder, we have determi the degree of digestibility, the yield of crude nutritive matter and the of weight caused by ensilage. The composition of maize sown close wide varied considerably for a number of samples of green ensilaged maize grown in both ways; the crude fat and protein cont of the crop sown close was inferior to that of the other accord to comparative feeding experiments on sheep; the digestibility of maize after being ensilaged was the same in the two cases. The produc of crude nutritive matter varies exclusively with climatic conditions, after a normal amount of rainfall it is the closely sown maize that yi most, while after a dry summer the reverse is the case. Nevertheless difference is not proportional to the greater expense of sowing maiz drills wide apart.

Considering: 1) that the later harvest of maize sown in drills w apart delays ploughing operations considerably; 2) that it is m expensive than close sowing; 3) that it is only in dry years that greater cost is balanced by the heavier yield, it may be concluded t wide sowing is only justified where drought is frequent.

Our Station has also determined the losses caused by the ferme tion of other important fodder plants, such as lucerne, beets (tops leaves) and the stalks of common maize. We have recently made sim experiments on mangolds, and then by experiments on pigs we h determined the percentage of nutritive digestible matter in fresh and ensila ed mangolds.

The digestibility of ensilaged mangolds was somewhat inferior to t of the fresh mangolds. The coefficient of digestibility of the ash and the crude protein showed great divergence. On the total organic ma preserved in the silo there was a loss of 13.1 per cent., and on the t digestible organic matter it was 14.6 per cent. The greater part of the ab lute loss was in the carbohydrates, which make up the bulk of the orga matter of the mangolds, whilst it was the digestible protein which suffe

greatest relative loss (30.93 per cent.). As, however, the protein content angolds is very low, this loss deos not diminish the favourable results nsilaging. Besides, this result could be attributed not only to the ity of the mangolds but also to the duration of storage in the silo, h was 3 ½ months.

Considering that in Hungary the tops and leaves of beets are much as food for cows, we have determined the digestibility of this forage fresh and ensilaged, investigating also its influence on the production omposition of the milk. As the farmers who dispose of the tops and s of beets generally also get the pulp of the beets from the sugar ries we have compared these two fodders. These experiments, carried n two farms, were made on 66 cows. They have demonstrated that ng the same quantity of wilted tops and leaves and acid pulp instead sh pulp increased the milk yield and the live weight of the cows, while pecific gravity and butterfat of the milk did not undergo any varia-

By feeding tops and leaves of beets in sour ensilage instead of an l quantity of sweet pulp, the milk yield, the live weight of the cows, the specific gravity and butterfat of the milk did not show any tion.

The chemical and physical properties of the butterfat produced by ng wilted tops and leaves in sour ensilage did not differ at all from : of the butterfat of the milk obtained by feeding with beet pulp, h is important from the point of view of the manufacture of butter. The milk of cows fed on beet pulp and tops and leaves, wilted or as ensilage, coagulated with the same rapidity and presented no differ- in the composition of the curd, so that cheese of the same flavour omposition can be made from the two milks.

Experiments and Points of View in the Study nimal Metabolism with the aid of the Respiratory Apparatus

by

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The scientific study of the nutrition of domestic animals was limited long time to the analyses of foods and to their comparison with the tions, from which the material used in the body of the animal was red. Though the analyses of food, connected with the analysis of olid excrements and of the urine, rendered possible the determination he *digestibility* of foods and of the proportion of proteins retained le body, and, in comparison with the simple analyses of foods, repre- d a considerable step forward, still simple practical observation ed that equal quantities of digestible foods by no means always

caused the same performance on the part of the animals, in the form either work or human food (milk, meat, fat). On these conditions uncertainty only the use of the respiratory apparatus could throw li because it allowed the consumption and the retention of the nitrogen components of the food and of the animal body to be determined with same precision as was formerly possible only for the nitrogen-contain substances by means of the analysis of the urine. The method of keep account of animal metabolism by determinations made on excreta temporaneously with those on the respiratory function, according Pettenkofer's method, was first applied to the larger domestic animal Growen, then in a considerably improved form by Henneberg and S mann; finally, it became so accurate in the hands of Gustav K and especially of Kellner that it afforded the possibility of obtaining on the effect of the most important foods in the animal body.

The simplest conditions are those offered by the Carnivora, in w the food contains very little inert matter, so that the greater par it is digested and utilized in the body of the animal. Consequentl was with Carnivora that Bidder and Schmidt, Bischoff, Voit and Ru were able to establish the first precise laws on the relation between matter taken into the body and that retained by it. A schema of the cesses involved, which, though not true under all conditions, is very suit as a basis for further considerations, is afforded by the substitution, dem strated by Rubner for certain cases, of the transformed component p of the body and of the foods in proportion to their combustion heat. Ru called isodynamic those quantities of different foods which have the s effect in the body in keeping up its composition, and found that such q tities of food as, on being burned, produced the same amount of proved isodynamic.

This view harmonizes with the experience which I had also acquired with Von Mering on the quantity of oxygen which ani take up with various foods. We found that the consumption of ox of an animal is not noticeably altered when foods which previously not exist in large quantities in its body are introduced directly into blood; this was shown with sugar, organic acids, certain soluble prot and the products of their splitting up. The amount of heat produced combustion with a definite amount of oxygen is almost the same for foods; for proteids and fats it is almost equal, while for carbohydrat is about 5 per cent. higher. Consequently we also found that on suppl some of the latter, sugar for instance, the consumption of oxygen somewhat when the animal had previously performed its work, as is case in a state of hunger, at the expense of the fat of its body. The procal substitution of foods in relation to the heat produced in body by their transformation appears most clearly in the cas muscular work. For a certain mechanical work the organism, as conjunction with several collaborators, I was able to prove by means respiratory experiments, always requires the same energy expresse

ories, and this independently of whether it be produced by transformation of carbohydrates, fat or protein.

The isodynamism of foodstuffs with those constituents of the body that e burned under conditions of hunger does not exist when the former are l in greater quantities. An increase of consumption takes place, which very probably caused by the active work of the alimentary canal, and its scles and glands, as well as by the increased action of the heart, the kidys and other organs, caused by elaborating the food. This view of consiring the greater consumption after giving food as "work of digestion" is pported especially by the behaviour of herbivorous animals, which take quantity of inert matter in their food. In the horse we were able to ve that an increase of the transformation much superior to that due the digestible nutriment takes place under the action of the crude re of plant food, and to such a degree that every gram of crude fibre the forage, which by its combustion would produce 4.2 calories, requires of these for the increase of the transformation that it renders necesy, that is for the greater work of digesting. A considerable portion of s work of digestion we were able to attribute, in the horse, to the work of stication, for during the mastication and swallowing of food rich in crude re an increase of consumption takes place; for hay this amounts to ut 10 per cent. of the total combustion value of this food. Kellner has ved in the case of cattle fed with straw that the consumption is much inished when the food is given finely ground or when it is freed from its rusting matter by the process adopted in paper making.

For these investigations, as well as for those on the effect of working animals upon metabolism, a method of carrying out respiratory experits which Geppert and I have elaborated, and which differs considery from Pettenkofer's, has proved the most suitable. We examined ctly the air exhaled, either by a fistula in the wind-pipe or, in the case nen, by suitable masks which prevented all losses. This method (1) is erior to Pettenkofer's in that we could analyse with the same precision only the carbonic acid given off, but also the consumption of oxygen, measure exactly the combustion processes in the animal body for short ods, even for only a few minutes. We were thus able to ascertain isely the effect of *every kind of muscular work* in man and in animals also the effect which the *food exerts in the various stages of digestion.*

Not less important than the possibility afforded by our method of ying out analyses during any short space of time, is the fact that we ascertain at the same time and with equal precision, the consumption xygen and the production of carbonic acid. Only in this way is it ible to become acquainted with the nature of the foods transformed he body, for foods differ in their ratio of oxygen consumption to on dioxide production during combustion. This ratio, the so-called iratory quotient, is especially different in fats and carbohydrates. volume of carbonic acid produced divided by the oxygen consumed

(1) Cf. accurate description by MAGNUS LEVI, *Pflügers Arch.*, 55, p. 1.

gives 0.7 for the former and 1.00 for the latter. When, in feeding, fat formed out of carbohydrates, the quotient rises above 1.00 and can wi intense feeding attain the value of 1.34 (Bleibtren, with geese fattene on oatmeal cakes). When the carbohydrates of the food undergo fermen ative processes in the digestive tract, in which hydrogen and methane a given off, the quotient of the total exchange of gases can also rise consid ably over the unit. In these cases the determination of the producti of carbonic acid alone is not sufficient to give an approximately exact id of the transformation of energy in the body.

During the last few years we have gained in several directions a deep insight into the processes of metabolism by means of a combination of t method for measuring the direct respiration of the lungs with an inv tigation of the 24 hours respiration processes in the closed chamber, harmony with Pettenkofer's principle. In these long continued expe ments, also, the great value of the simultaneous determination of the co sumption of oxygen and of the production of carbonic acid has be recognized. The investigation into the transformations taking place in t animal body deals essentially with three classes of foods: proteins, fa and carbohydrates, which also differ considerably in the quantities carbonic acid given off in the production of equal amounts of heat. If, in the older metabolism investigations, we determine only the producti of nitrogen and carbon (as carbon dioxide), we are only capable of asc taining how much nitrogenous material, *i. e.* protein, has been tra formed and how much carbon has been formed from nitrogen-free mate (fat+carbohydrate). But if we want to know how much of each of th foods has been transformed, and this is necessary if we want to calcul the quantity of energy developed in the body under the form heat, we must determine a third factor which allows us to dist guish between these two classes of nitrogen-free foods. This th factor can be either oxygen or the quantity of heat produced the animal; the two factors are about equally suitable. For, w an equal production of carbonic acid, fat produces about 24 per ce more heat than carbohydrates and requires about 41 per cent. m oxygen. The choice of methods thus depends chiefly upon the relat facility and reliability of measuring the heat on the one hand, or t consumption of oxygen on the other. In the present state of techni knowledge, the determination of the oxygen, especially for short perio is the more exact method. The best is to determine both factors, as h been practised by Benedict and his collaborators in recent experimen In the generation of heat we have, then, a very valuable control of results calculated from the production of nitrogen and carbonic acid the absorption of oxygen.

The method developed by me for the determination of the consumpt of oxygen in experiments lasting any length of time, is only an improvem on the respiratory apparatus used for small animals by Regnault Reiset, before Pettenkofer.

The disadvantage of this apparatus was that the carbonic acid content the air of the box was abnormally high, and that it was also permanently urated with aqueous vapour, besides which the odorous emanations from alimentary canal accumulated in it in increasing quantities. The way which all these inconveniences have been avoided in my apparatus is cribed in detail in Vol. 44 of the *Landwirtschaftliche Jahrbücher*. I y mention that it is possible to determine with it the consumption of gen, the development of carbonic acid, and also, if desired, the evapo- on of water from the animal body, with equal precision, and that dur- the whole time the air of the chamber can be kept dry and free from urs. In another direction also, which is especially important in research k on ruminants and on pigs, I was able to improve on Pettenkofer's hod by providing greater precision for the determination of the com- tible gases. Among these, methane is produced by ruminants in such ntities that it accounts for about 10 per cent. of all the carbon emitted er the form of gas, as was determined first in the experiments of Pet- kofer, and later confirmed by Kühn and Kellner. The method of nault-Reiset as used by us has the advantage that these gases remain rely in the respiratory chamber up to the end of the experiment, and therefore their percentage in the air to be analysed is much higher can consequently be determined with greater precision. We succeeded in estimating exactly the amount of hydrogen formed. This is n produced together with methane in the intestinal fermentations, is important in some experiments, for instance in those after feeding e quantities of foods containing sugar. Up to one-fifth of the bustible gases consisted of the hitherto neglected hydrogen, and the portion of this gas is still greater in the intestinal fermentations in Even a considerable accumulation of hydrogen and methane e air of the respiratory chamber are of no consequence, as neither of gases is poisonous and they have no more effect than the nitrogen of atmosphere.

We have already mentioned that the nutritive value of a food is consi- bly modified by the amount of energy which is lost in its digestion and ilation. It must be added that, with many foods, there are notable s in the later transformations undergone in the body (specific dynamic t according to Rubner), and that these losses play an important part proteins. To these two causes of disagreement between the heat pro- d by combustion of the food and its nutritive value in the body, a third , especially active in ruminants, may be added, *viz.* the loss of energy ugh fermentation. Kellner attempted its determination and made allow- for it in his experiments by determining the combustible gases de- ed. It is, however, clear that the combustible gases make up only a of the loss. We know that every fermentation which is a vital pro- of lower organisms is connected with the consumption of energy: we ve an instance of this consumption of energy in the heat given off in fermentation of yeast. Such "fermentation heat", produced e fermentations in the intestine, can only be of use to the animal in

those rare cases in which the heat produced by metabolism is not enou to cover its requirements. This happens with ruminants only when th find themselves in very cold surroundings in winter. Otherwise, the he given off by fermentation processes, like that produced by fatiguing mu cular work, must be got rid of by special work of the body, such as increas circulation of blood in the skin and secretion of perspiration, that is l consumption of energy.

From the above it is seen that the nutritive value of a food cannot calculated simply from its content of digestible nutriment. From the qua tity of energy that these digestible nutriments contain, the following ha to be deducted: the work of digestion connected with their assimilation, t specific dynamical effect for their transformation into components of t body, and the losses by fermentation. From what has been previous said, it is evident that, among these factors, the work of digestion depends an extraordinary degree upon the mechanical constitution of the food, up its state of division, and upon its content of crude fibre. Similarly th loss by fermentation must be reckoned with, to a greater extent in ruminant to a lesser one in other animals; of this loss, hitherto we have on known a part, namely that represented by the combustible gases le ving the body, while the loss in fermentation heat has never y been determined. As the fermentation processes vary considerably extent in the various domestic animals, the utilization value of a food c only be given for a particular species of animal. Consequently the gre number of determinations of the utilization value of foods, made by Kellu by means of Pettenkofer's respiratory apparatus, are true only for rum nants, or, to be still more precise, only for cattle, since in sheep it appears th the processes of fermentation are different. This fact must be borne mind when using the "starch values" introduced by Kellner for conv nience in calculating feeding rations. Under the term "starch value of a food, he designates that quantity of a food which lays on as much as 1 kg. (2.2 lbs.) of starch.

In the horse, only a small proportion of the starch or of the sta containing grain that is fed, ferments, while in cattle upwards of 10 per c of the heat of combustion of the digested food leaves the body unutili as methane, besides which, another quantity of heat, which I provis ally estimate at about 70 per cent. of the heat of combustion of the methe is lost as fermentation heat, while with fat no such loss occurs either horses or in cattle. Consequently the ratio of the nutritive value of fat starch is quite different in cattle and in horses. In pigs it is about same as in horses. Thus if we apply to pigs or horses the same sta value for a fat food, such as an oil seed, as was determined by Kellner cattle, we commit a notable error. But this is not the only uncertainty these calculations. I may state that an important result of the investi tions conducted of late years in my Institute has been to show that the sa food may undergo very different losses by fermentation. According to proportion in which a food is given, it ferments with greater or les intensity and suffers different losses. Of especial importance is the fact th

fermentation of easily soluble sugars in the paunch of ruminants is from to five times more rapid and intense than that of starch. Not less ortant is the fact that owing to the presence of such easily fermenting stances, the fermentation of cellulose, which is indispensable for the tion of the food, is considerably limited. Up to a certain point, the sequences of these irregularities in the fermentative processes have been known. It is thus known that foods rich in sugar, especially s, cause a so-called "depression of digestion", that is, that they ibly diminish the solution of cellulose and consequently act unfavour- on the total utilization of the food. What hitherto was not known, which appears evident from our experiments, is the fact that even ll changes in the composition of a food can have a great influence on itilization. In corroboration I shall mention some experiments on nutritive value of potato distiller's slop compared with the raw ma- l from which it was made.

In collaboration with Von der Heide and Klein, I have published port of these experiments in *Landwirtschaftliche Jahrbücher*, Vol. 44, 15. In four series of experiments a supplement was added to a basal n of hay fairly sufficient to cover the requirements of the animal; it isted in the second period of 5.5 lbs. of dried potatoes with the quantity alt and yeast necessary for its fermentation. In the third period the lement consisted of the slop produced by the same quantity of pota- plus the amount of starch which had been lost by fermentation. In the h period the same quantity of energy which had been fed in the two ious periods was fed exclusively in the form of slop. The supplement was y equivalent, in respect of its combustion heat, for it corresponded:

in the	2nd	period	to a	quantity	of heat	equal to	92.53 calories
»	3rd	»	»	»	»	. . . .	92.37 »
»	4th	»	»	»	»	. . . .	91.73 »

The fat and flesh laid on by the animal corresponded in the three ds to the following percentages of the combustion heat of the supple- s:

2nd	period.	47.8	per cent
3rd	»	33.78	»
4th	»	48.80	»

Of special significance is the comparison between the second and third ds, in which exactly the same food was given, except that in the third were the modifications caused by the growth of the yeast and the ition of the bye-products of the transformation of starch into ol. The different effect of slop + starch mixture compared with riginal material is shown almost more strikingly by the fact that second period 33 grams of protein were laid on daily by the animal, in the third period 21 grams were lost, than by the combustion value e material laid on.

The amount of fat laid on in the 2nd period was . . . . 446 grams
" " " 3rd " . . . . 341 "

If these experimental results are calculated according to Kellner principle of the starch values of foods, it would appear from experiment that the 2428 grams of slop fed, since they caused the laying on of 44 calories, acted as 1897 grams of starch, which gives 100 parts by weight dry slop 78.13 parts of starch value. This figure is about twice as hi as the starch value which Kellner attributes to potato slop, without, ho ever, basing it upon direct experiment. In opposition to this extreme favourable nutritive value of slop in the case of exclusive feeding togeth with hay, it shows itself much inferior in combination with starch. F the 1984 grams of crude starch containing water correspond to 1570 gra of pure starch, while the total material laid on, 3120 calories, corresponds 1322 grams of starch value. In this case, then, the added slop had a negati value in its nutritive effect. The explanation lies exclusively in the enormo losses by fermentation caused by the combination of slop and starch. Th the difference of fermentation, as it appears in the above example, was n due to change, could be proved by a further series of experiments Markoft in which the fermentative processes were examined directly in t contents of the paunch extracted by means of the oesophageal tube (cf. *B chem. Zeitschrift*, Vol. 34, p. 210, and Vol. 57, p. 1). The technical part of th experiments is fully described in the latter volume. It led to the pr that the addition of easily soluble carbohydrates, or the addition of soluti proteins or of amides, on a stomach content poor in protein, increases t fermentation to a considerable extent. But not only is the intensity fermentation, *i. e.* the quantity of methane produced, deeply modified changes in the composition of the contents of the paunch, but also t kind of fermentation, and consequently the magnitude of the losses. Duri the experiments, not only the quantities of the gases developed (C and H_2) were determined, but also the quantities of volatile fatty ac formed as fermentation products, which represent the utilizable produ of fermentation. It was seen that for equal quantities of combu tible gases, and for equal quantities of transformed carbohydrates, t quantity of fatty acids produced was very different, and consequent that the utilizable portion of the fermented carbohydrate varies ve much according to the quality of the fermentation. In many cases, t common fermentation in which mainly butyric acid and methane formed, is replaced by one in which the chief product is lactic acid w insignificant quantities of combustible gases. In this case the utilization the fermented food is considerably more favourable than when methane is veloped in great quantities, but cellulose appears to take but little or no p in this kind of fermentation. The cell membranes not being sufficien opened, it leads therefore to a greater depression of digestion, which the end makes it appear less favourable to the animal than the usual m thane fermentation.

Further it has been observed during the above-described fermentati experiments, that fermentation can be very different when ensilaged fora

as ensilaged beet leaves or potato haulms is fed. Consequently all ng data on the nutritive value of such ensilaged foods must be revised. well known, hitherto, with all such kinds of foods, the loss of carbo- ites has been calculated under all circumstances as an equally large f nutritive material, whereas this view is not justified, because the ic acids formed in the course of fermentation are directly available to imals, while most, if not all, of the carbohydrates fed in the fresh r ferment in the paunch forming the same acids. From the above it is it that many parts of the hitherto accepted theory of feeding require on.

We must no longer attribute to a certain food the same nutritive value all circumstances, as has hitherto been done. We must rather find out at combination the nutritive value of a food proves the most advan- is. We must learn to avoid the causes which depress digestion and the nutritious matter by excessive fermentation, and, on the other hand, ose such combinations of foods that the least easily digestible ns of the food are utilized to the greatest possible extent.

itherto we have been able to carry out only a few experiments in w field of research. A series of experiments published in the *Landwirt- iche Versuchsstation* (Vol. 79-80) should be mentioned here, as it shows ne and the same food has a very different effect according to the way ch the various components of the same are mixed together. A food ing of hay, starch, rye meal and linseed cake caused a greater forma- fat, and consequently a higher utilization value, when all the hay and seed cake were given at one feed, and the starch-containing foods at ter. In this case the stimulating effect of the concentrated food rich men favoured the fermentations and the dissolution of the crude the hay, while in the check series of experiments in which the starch ven together with the hay, the crude fibre of the latter was digested naller extent, so that the final result, namely the laying on of fat, ich less.

the same principle as these experiments, the results of which een published, other series of experiments have been carried out e object of showing how the utilization value of a food is influenced pecial mechanical constitution and by the way in which the various ients are mixed and set to ferment together in the paunch. In this series of experiments was carried out in which partially exhausted uckerschnitzeln) were compared with completely exhausted slices to olasses had been added to bring them up to the same sugar content others, the object being to ascertain how far the envelopment of ar by the cell membranes, which occurs in the partially exhausted rotects the sugar against losses by fermentation.

other experiments molasses were given in various combinations with ods. The effect on the fermentation when molasses was given ink was also tested; in this case it is not so intimately mixed e rest of the food as it usually is when fed together with forage ntrates. In yet another experiment molasses was mixed with

peat, as is frequently done in practice, in order to isolate it, to a certain degree, from the other foods in the paunch by means of this substance not liable to fermentation.

I anticipate important results from a series of experiments commenced during the summer in which the same forage was given dry and ensilaged. In valuing the nutritive value of ensilage, hitherto too decisive a part has been played by the simple analysis of the food, which showed that many carbohydrates were transformed into organic acids, thus causing heavy losses of combustibles gases. It has not been sufficiently considered that the fermentations in the silos proceed to a certain extent similarly to those in the paunch, and that possibly a part of the loss by fermentation in ensilaging is made good by a reduced fermentation in the alimentary canal of animals. This question is at present under investigation in the above experiment. At the same time it will be seen whether the presence in the paunch of material already fermenting is capable of altering the normal fermentation and, under some circumstances, of increasing or of diminishing the losses by fermentation. It will be seen from the above how complicated the question is, and how important is its solution in stock feeding. It will therefore be necessary to continue fermentation experiments on the contents of the paunch side by side with metabolism experiments in cattle in order to isolate the different factors involved, which are, as the metabolism experiments would lead us to conclude, the result of the intimate connection between digestion and fermentation processes and of the transformations which take place in the animal organs. Already a number of Dr Markoff's experiments with paunch contents show that the presence of ensilaged food modifies very sensibly the fermentation in the paunch and that under certain circumstances the fermentation losses are considerably diminished by it.

An important result of the experiments hitherto made, in which the 24 hours metabolism experiments in the respiratory chamber were made simultaneously with direct lung respiration investigations over a short period, is the recognition of the fact that unaltered carbohydrates scarcely enter into the metabolism of ruminants, and that, instead, all the material is transformed by fermentation in the paunch into organic acids and perhaps partially into alcohol. This is clearly seen by the relatively low values of the respiratory quotient of the animals. The low quotients are an index of the oxidation of the nutritive substances which are circulating and being burned in the body; in ruminants these are very different from those taken up in the food, which, in splitting up through fermentation, give off large quantities of carbonic acid together with combustible gases. Of this carbonic acid produced in the paunch very little is resorbed and exhaled through the lungs, the greatest quantity being passed out from the paunch through the oesophagus. In Pettenkofer's apparatus these quantities of gas mingle with the real respiration gases evolved by the oxidation of the fermentation bodies (mainly fatty acids) in the tissues of the body.

Experiments made by direct pulmonary respiration with a food whose plete combustion should give a quotient of 1.0 and even something e, on account of the formation of methane, gave figures between 0.76 a maximum of 0.92. Parallel experiments in the respiratory chamber ded the high respiratory quotient as calculated from the composition ie food. A very remarkable difference in the constitution of the organs ittle and in horses is explained by this transformation of food in the ch. In horses the liver as well as the muscles are always very rich serve carbohydrate (glycogen). In cattle the glycogen content of the ns is very low (1). The explanation is that, in the former the carbohyes of the food enter as such into the circulation, whilst in ruminants these completely reduced to fatty acids, from which, in the animal body, very little, if any, glycogen is formed.

A further series of problems to be solved by respiratory experiments, h have been begun on Carnivora and omnivora, is that concerning expenditure of energy required for the transformation of food into ituents of the body as it takes place in growth, in fattening, in the uction of milk and in the growth of the foetus, as well as in the proion of eggs in birds. Investigations into these subjects have recently undertaken by Von der Heide and Klein (2), Dienes (3), Morgulis, ow and Gerhartz. A part of the results of the experiments has already published. The whole of the work done confirms a fact that Kellner had dy pointed out, but which in his works could not appear with due clearon account of the losses due to fermentation and to the great amount of required by digestion in herbivorous animals, namely that every assiion of food in the body is attended by a considerable loss of energy. In words the excess of food which is given for the purposes of production r accomplishes its object without losses. A considerable proportion is med in the chemical processes which transform the food material into ic substance. These losses are greatest in the laying on of proteins, curs in growing animals, but they are also very considerable when the ntained in the food is deposited in the animal body during the fattenrocess, as has been found in Von der Heide and Klein's experiments pigs, notwithstanding the fact that into this process chemical es scarcely enter. The consumption of energy in the growth e foetus and in the production of milk are more easily reed by the experiments of Dienes. It appears that in the days of pregnancy, during which the foetus grows most, and during lactation, the process of combustion is increased by 26

1) The difference is so constant that it has been used as a test to distinguish beef orseflesh.

2) Von der Heide and W. Klein. Stoff und Energie Ansatz des Schweines bei tum und Mast, *Biochemische Zeitschrift*, 55, p. 195, 1913.

3) Dienes, S. Beitrag zur Kenntniss des Stoffwechsels in der Schwangerschaft und ctation, *Ibid.*, p. 124.

to 29 per cent. This increase is naturally greater the more organic s stance is produced. Thus in the case of cows yielding much milk, besi the addition to the rations required to provide the material for the m a further considerable supplement must be given to cover the work of p duction. This supplement is estimated according to the results of pr minary experiments at from 50 to 60 per cent. of the energy of the n produced. The experiments of Gerhartz on the transformation of ene in the laying hen are more complete than any hitherto made on production of milk (1). In this work of production, in which a spe material in the form of eggs is produced in large quantities by the anir the expenditure of work expressed in calories is equal to the whole comb tion value of the mass produced.

I hope that with the help of the methods described above and of investigations now under way it will be possible, in the course of the n few years, to throw so much light on the subject as to enable pract rules for the science of feeding to be drawn up.

(1) The paper is being printed in *Arch. f. d. ges Physiol.*

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

. Legislative Measures Relating to the Trade in Silkworm Eggs. — *Enquiry nade by the International Institute of Agriculture.*

In order to obtain information as to the legislative measures dealing ı the trade in silkworm eggs (" graine ") at present in force, the In- ıte addressed a circular letter in September 1913, to the Department ıgriculture of each country in which the raising of silkworms is of im- ıance, asking whether any such measures existed in the country. Further, ecial question asked whether it was obligatory that silkworm eggs for sale ıld have been raised by the Pasteur system.

A large number of answers were received, frequently accompanied by ious publications dealing with the subject ; the following is a summary he information received.

Australia. — No special measures or regulations exist in any of the s of the Australian Commonwealth.

Austria. — So far the necessity for special laws has not been felt, as ilturists, of their own accord, only employ the eggs prepared on the Pa- system, and the trade has rigourously excluded all material not so ıred. The Agricultural Experiment Station at Görz serves as a ıltural testing station, and, when required, tests the graine and ls certificates.

The Sericultural Institute at Trent, which was created by the agri- ıral council of the province, produces large quantities of graine, using cellular method exclusively. The above Institute only began to ly the graine in 1885 ; at the present day it furnishes about two- ls of the total quantity required by the country. The whole process g production, as well as sericultural courses for men and women, arried out in the building specially erected in 1894 at a cost of 000 crowns (over £ 14 000).

Bulgaria. — Both the internal trade and the import of graine regulated by the « Law on the development of the silk industry Bulgaria », which dates from January 24, 1906, and contains the follow provisions:

Production of graine in Bulgaria may only be carried out under Government superv and with the use of the cellular system.

In order to become a producer of graine a special permission is required, and the tech operations must be directed, by certificated members of the staff who have attended a sei tural course either in Bulgaria or abroad.

The despatch or consignment of graine is prohibited before March 15.

Producers of graine must give written notice to the Department of Commerce and culture, previous to March 1, as to the amount of graine they intend to produce, and b April 15 must furnish a list of the silkworm raisers who have been provided with grai well as the amount provided in each case.

Government inspectors visit the breeding houses and make a rigorous inspection c microscopical selection work.

In the event of disputes arising between the producers of graine and the Governmer thorities, matters are refered to the court of justice for trial.

The graine must be put on the market in little sacks containing exactly 10 or 30 g these must be enclosed in boxes bearing the name of the firm which produced them, an race and weight of the contained graine. Such boxes are further wrapped round with a band provided free by the Government. No variation of this system of packing is perm

Importation of graine from abroad is allowed from August to November 15 or fro bruary 1 to March 1 if the necessary authorisation has been obtained from the Govern who also inspects such consignments. The graine must have been produced by the P system, must be pure and unadulterated, and should be accompanied by samples of the co from which it was produced. Imported graine if declared marketable is provided wi official bands mentioned above, but if declared defective or infected must be redisp abroad immediately by the consignee; in the case of failure to comply with this order 10 days, the graine is destroyed on the spot. The official bands for imported boxes are c 5 centimes for boxes containing 10 gms. and 10 centimes for boxes containing more 10 gms.

The Government suspends for three or five years the importation of graine from firm do not show proper homogeneity in their samples of cocoons.

Producers in those countries with whom Bulgaria has concluded a commercial trea subjected to the conditions laid down in the treaty in question.

A special convention between France and Bulgaria, dating from January 1906, re the import trade from that country. The graine must be produced on the Pasteu ciple and imported in sacks each containing the moth or in boxes bearing a band whic stitutes an official guarantee from the French government, and which allows the boxes t through without inspection by the Bulgarian officials. Without the band the materia be examined within a month, either by the purchasor under the supervision of Governm ficials or by the latter themselves. The application of the Bulgarian official band is c 1.10 fr. per 100 sacks examined if the work has been done by the Government official the work was done only under the superintendence of Government officials, the charge is times and 5 centimes per box of 30 gms. and 10 gms. respectively.

Even with French consignments the purchasor requires Government authorisation, t cannot be refused unless the graine sent does not correspond with the description on the band or on the box containing the bags of graine. Importation is allowed from Augu December 1, or from February 1 to March 15.

China. — No laws or regulations relating to the silkworm egg trade exist. ly the sericultural schoools put on the market graine which has been sub- ted to microscopical examination, and such graine is put into boxes ring the school seal, but the peasant rearers prefer to buy their graine n merchants. The latter collect eggs of various species and indicate place of production on the wrappers, as well as append their own l

Besides the peasant rearers who merely raise silkworms from eggs col- ed themselves, exercising a rough kind of selection, there are certain ers who make a special business of producing graine for sale.

The Department of Agriculture and Forests has brought forward pro- als for laws and regulations on the silkworm egg trade and the silkworm stry generally, including preventive measures for disease etc., but at e end of 1913 such proposals had not yet been made law.

France. — The Government control was instituted by a decree on April 1907 supplemented by a ministerial instruction on April 24, 1912. Pro- ers are not obliged to submit to the control but those who do submit ive Government guarantee for their goods.

A special inspector staff is made up of sub-inspectors who superintend production and boxing of the graine, and of inspectors who organise direct the operations of the above officials. The inspectors must assure uselves, by means of surprise visits, that the graine is produced exclu- ly by the Pasteur method, and that the conditions generally warrant fixing of the official band to the boxes. The sub-inspectors visit the vators who raise the cocoons for the graine-producing establishments, ell as the latter themselves.

In the selection of the cocoons, the type and quality of each different s examined, and the number making up the lot is noted. Great s is laid, of course, on the microscopical examination of both pupae moths.

During the washing, drying, cleaning, and boxing of the eggs, the sub- ctor has to see that no adulteration takes place. He is further respon- for marking the exact weight of eggs on the official band of each box, ell as the name and address of the producer, and the race and colour of ocoons.

Producers of graine who wish to be under Government control must in to the State Department of Agriculture a special form every year e March 31, in which they undertake to subject themselves to all the ribed regulations for both the internal and the external trade, and to sh Government officials with all the necessary facilities for carrying heir work of inspection.

Greece. — No special regulations exist, but the Government meditate ing in such measures shortly.

Hungary. — All matters relating to sericulture and the silk industry been in the hands of a special government department since 1880, The Royal Inspectorate for the Development of the Silk Industry in ary". It was decreed by law in 1885 that the Inspectorate alone

should have the right to distribute gratis to all who wished to rear the wo graine produced by the Pasteur system. The cocoons are then acquire the Government at a fixed price of 2.35 crowns per kilo (10 ½ *d* per in which allowance has been made for the value of the graine distrib free. The Government has erected a Sericultural Institute at Szeksz in this 280 microscopes are kept in use, selecting annually 6 to 7 mi pairs of moths for the cells, each pair being subjected to microscopical mination by three different members of the staff. To maintain the r vigour, about two million cells containing moths are imported annu from Italy or France, and the graine produced by these couples is di buted the following year.

India and British Crown Colonies. — No special regulations exist India attempts have been made to induce cultivators to use selected g exclusively, and facilities for its acquirements have been granted in raising districts. In Ceylon imports of graine have been limited to sele material from Italy or from the Government establishment in K mir, and such precautionary measures will undoubtedly be conti in future.

Italy. — No special regulations exist other than art. 15. of the law 869, July 6, 1912, dealing with the silk industry, in which it is stated th silkworm eggs consigned by post or railway and gone astray in tra must be destroyed instead of being sold as is usually the custom with goods. Nevertheless there are numerous firms which carry on a busi in graine both at home and abroad and which produce their eggs on Pasteur system and guarantee the material they supply. Further, the Royal Experimental Stations of sericulture of Padua and Ascoli Pic as well as the Sericultural Departments of the Royal Agricult Colleges of Milan, Portici and Perugia, and numerous other small cicultural stations (" osservatori ") exert a considerable benef influence on the commerce of graine.

Japan. — There exists a fundamental law for the silkworm egg t dating from March 29, 1911, No. 47, which is known as « san-shi-gyo- Other regulations concerning the execution of this law are as follo

a) Imperial decree of July 29, 1911 (No. 214), on the right of inspecting graine.

b) Imperial decree of November 22, 1911 (No. 276), on the organisation of a comm for the inspection of graine.

c) Decree of the Department of Agriculture and Commerce of November 3, (No. 30), relative to the application of the above law.

d) Instructions issued by the Department of Agriculture and Commerce, Decemb 1911 (No. 19) relating to the said law.

e) Notification from the Department, December 6, 1911 (No. 571), relative to preve measures against silkworm diseases.

f) Ministerial decree, 1911 (No. 31), with regard to the organisation of the Bure Inspection for Sericulture.

g) Ministerial decree, May 1, 1911 (No. 21), relating to the subvention granted fo couragement of improved methods in the production of graine.

Japanese law lays down that all graine put on the market must have
n produced by the Pasteur system, details being given in the above -
ntioned document (*e*).

Roumania. — No special laws are in existence. Imports are all
jected to examination by the sericultural station before being allowed
circulate in the country. All graine must be produced by the Pasteur
tem and be free from all disease.

Russia. — No special laws exist, but measures are now being discussed
this connection.

Spain — A royal decree dating from May 16, 1913, prohibits all im-
ts from France unless the latter bear the official bands which constitute
overnment guarantee. Imports from other countries are subjected to
special regulations and the graine may be either cellular or industrial;
iact, it more usually consists of the industrial variety.

- **The Institution of a Technical Commission of Agricultural Meteorology at the "Direction générale des Eaux et Forêts" in France.** — *Ministère de l'Agriculture, Bulletin mensuel de l'Office des Renseignements agricoles*, Year 13, No. 1, p. 8, Paris, January 1914.

By a Ministerial Decree of January 6, 1914, a technical commission
Agricultural Meteorology has been established at the French Ministry
Agriculture. The commission consists of 30 members who are nominated
three years by Ministerial decree, and it is attached to the " Direction
iérale des Eaux et Forêts ». Its duty is to give its opinion upon the
lies to be carried out in the different agricultural districts of France,
n the establishment and management of the Stations and Posts of Ob-
ation and upon all question laid before it by the Ministry of Agriculture.

- **Some Data on the Agriculture of the German Protectorates.** — *Die deutschen Schutzgebiete in Afrika und der Südsee* 1912-13, *Amtlicher Jahresbericht, herausgegeben vom Reichs-Kolonialamt*, pp. 82-111 and 121-128. Berlin, 1914.

The following data on the agriculture and trade of the German Pro-
orates are taken from the official report of 1914 published by the Im-
al Ministry for the Colonies on the German Protectorates.

Among the various branches of German colonial economy, agricultural
iuce occupies the first place. During the year dealt with by the Report,
plantations enjoyed, in the main, favourable market conditions, as the
ts of the low prices for rubber were not yet much felt. The rubber
tations in Germany East Africa have been considerably extended.
l yielded a good crop which sold easily at good prices. The production
offee increased. The plantations in Kamerun are progressing; a new
ich, bananas, has a good prospect for the future, owing to the formation
firm for their export. In Togo the plantations have increased in num-
and in extent. In German New Guinea also, the area under planta-
s has considerably increased. It is satisfactory to note the progress in
growing of other produce, such as rubber and cacao, besides coconuts,
use the exclusive production of copra presents serious drawbacks
the point of view of colonial economics. At Samoa the cultivation
levea has made much progress.

TABLE I.

	German East Africa		Kamerun		Togo		South Sea Protectorates			
							German New Guinea and islands		Samoa	
Total area	1 339 637 acres		284 539 acres		28 091 acres		457 000 acres		122 460 acres	
Number of plantations	707		58		—		—		34	
White employees	606		195		9		212		81	
Coloured labourers	83 366		17 827		841		15 116		2 118	
Crops	Cultivated area		Cultivated area		Cultivated area		Cultivated area		Cultivated area	
	Total acres	Productive acres	Total acres	Productive acres	Total acres	Productive acres	Total acres	Productive acres	Total acres	Productive acres
Maize	9 365	9 365	—	—	—	—	—	—	—	—
Rice	1 152	1 152	—	—	—	—	72	32	—	—
Sugarcane	341	341	—	—	—	—	94	94	—	—
Other cereals	5 807	5 807	—	—	—	—	7	5	—	—
Coconuts	20 209	4 900	—	—	1 628	660	73 228	26 540	12 080	9 585
Oil palms	257	15	12 564	4 070	145	—	—	—	—	—
Pineapples	—	—	—	—	—	—	10	10	25	25
Bananas	383	383	5 347	976	—	—	12	5	238	238
Fruit trees	608	608	—	—	—	—	—	—	—	—
Other fruit	568	568	—	—	—	—	158	158	23	23
Cacao	297	173	32 522	20 201	452	198	974	507	8 928	3 740
Coffee	11 869	5 414	264	25	—	—	22	15	7	7
Tobacco	40	40	378	227	—	—	7	7	—	—
Spices	(Pepper) 136	136	(Kola) 405	44	(Kola) 1	1	(Kola and nutmeg) 20	5	(Kava(*) 47	47
Rubber	111 982	42 295	18 291	2 555	430	49	5 780	2 963	2 871	533
Cotton	31 978	41 978	—	—	—	—	—	—	—	—
Kapok	6 504	1 584	—	—	12	—	—	—	18	18
Manila hemp	—	—	—	—	—	—	20	15	—	—
Mauritius hemp	—	—	—	—	—	—	—	—	—	—
Sisal hemp	61 162	35 482	—	—	650	168	193	69	—	—
Fourcroya	—	—	74	54	—	—	—	—	—	—
Total	262 857	140 949	69 743	28 152	3 318	1 076	79 597	30 485	23 237	14 276

Table I gives a synopsis for 1912 of the plantations belonging to Europ ns in all the German Protectorates.

Farming in German South-West Africa has not yet felt all the bene- expected from the new railways, but it has nevertheless developed very sfactorily. Notwithstanding the small amount of rain and the poor turage, the live stock of the farms has increased as well as the number of latter. In 1913 there were 1 331 farms comprising 33 096 806 acres, inst 1 245 farms with 32 001 861 acres in the previous year.

Table II shows the number of head of Live stock in German South- st Africa in 1912 and 1913 and those of East Africa and German v Guinea in 1913.

TABLE II.

Live stock	German South-West Africa		German East Africa 1913		German New Guinea 1913
	1912	1913	belonging to Europeans (501 farms)	belonging to natives (*)	
e	171 784	205 643	43 617	3 950 250	2 572
) for wool, ...	46 901	53 691			
an sheep	12 588	17 171			
kul sheep	4 094	11 194	41 647	6 398 000	sheep 891
an sheep for meat . . .	422 481	472 585			
ra goats.	10 387	18 163			
es	448 279	485 401			goats 556
s.	13 340	15 916	202	10	421
non goats	7 015	8 563	2 543	22 091	17
s.	4 879	5 055	375	52	6
. . . . .	7 195	7 772	5 460	497	2 706
ds	789	709	—	38	—
ches	1 277	1 507	173	—	—
ry	71 753	87 386	—	—	15 019

*) The figures of this column are mostly estimated.

The establishments of the Administration for the Promotion of Agri- ure have continued to develop and have displayed great activity, cially in German East Africa, where their number has reached eight. ensive veterinary measures for the control of cattle plague have been nized in the colony. The campaign against the diseases of live stock been continued in German South-West Africa. In German New uea the bases of a veterinary service have been laid.

In Samoa agricultural experimentation has been newly organized and ial attention is paid to the phytopathological service, while it continues levelopment in German New Guinea.

For forestry the chief measures have consisted in the creation of a forest reserves, especially in East Africa and in Togo. The forest reserv n East Africa extended, in 1913 (April 1), over an area of 1 833 817 acr against 1 197 040 in 1912.

The foreign trade of all the Protectorates rose in 1912 £12 890 000 (£11 760 000 in 1911), which is principally due to the total crease of Trade in East Africa; this rose from £2 330 000 to £2 970 0 The total import trade of all the Protectorates has risen from £6 968 to £6 991 268; while the exports have risen from £4 801 818 to £5 923 To this increase of exports German South-West Africa has contribu £540 000 and German East Africa £440 000.

Table III shows the principal animal and vegetable products export arranged according to value.

TABLE III.

	£		
Rubber	1 036 242	Timber	41
Copra	573 520	Wax	40
Palm kernels	381 500	Cattle	26
Sisal	361 114	Sesame	25
Cacao	265 296	Maize	14
Hides	212 268	Butter, milk, etc.	12
Palm oil	148 727	Rice	9
Cotton	128 621	Kola nuts	8
Coffee	93 284	Wool	7
Earthnuts	62 380	Tanbarks	4
Ivory	46 011	Ostrich feathers	4

301 – **The Establishment of a Laboratory at the Marseilles Colonial Inst for the Study of Cereals and other Starch-producing Plants.** – Pra EM. in *La Quinzaine coloniale*, Year 17, No. 34, pp. 861-862. Paris, December 2

The Marseilles Colonial Institute has decided to erect a laboratory the special study of cereals and other starch-producing plants cultiv in the French possessions. This laboratory will be furnished with all apparatus necessary for grinding and baking experiments with cereals, husking, bleaching and testing the hardness of rice, and for experiment obtaining starch and alcohol from other starch-producing plants. T technical investigations will be supplemented by the necessary botan determination of the plants, and by their chemical analysis.

302 – **Agricultural Shows.**

Austria.

1914 June-July. Vienna. — Flower show of the Imperial Horticultural Society. Of 12 Kaiser Wilhelmring, Vienna.

Sept. 5-8. Bruck. — Agricultural and industrial show, organized by the "Nieder reichischer Landeskulturrat" in conjunction with the municipality of Bruck an local Agricultural Association. Offices of the "Landeskulturrat": Stallburggas Vienna I.

Belgium.

Aug. 15-18 Huy. — Septennial International Horticultural and Agricultural Show. Adress to: M. Paul Maréchal, Statte Huy, Belgium.

Nov. 7-9. Brussels, Grand Hall du Cinquantenaire. — International Poultry Show, organized by the "Société centrale d'Aviculture de Belgique". Offices: Royal-Bourse, rue Henri-Mans 13-14, Brussels.

France.

May 26-31. Caen. — National poultry show, organized by the "Société d'Aviculture de la Basse-Normandie". M. Hédiard, 37 rue de Bretagne, Caen.

May 29-June 1. Biarritz. — International Show of Horticultural Produce, held at the time of the 18th Congress of the "Amis des Roses, Société française des Rosiéristes", under the auspices of the "Société d'Acclimationta du Golfe de Gascogne". M. Hurn-Sentouré, general sec., Société d'Acclimatation, Biarritz.

June. Paris. — Exhibit of useful and injurious insects and of insectivorous birds, under the patronage of the Ministry of Agriculture. The profits will go towards the foundation of Entomological Stations and Laboratories.

June 16-21. Paris, Champ de Mars — Second General show of Breeding Stock (cattle, sheep and pigs) organized by the Minister of Agriculture. The show of stud horses and asses will be held at the same time.

Germany.

Frankfort-on-the-Oder. — Three Horticultural Shows will be held by the Frankfort Horticultural Society in connection with its fiftieth anniversary, *viz.*: May 2-4, Aug. 15-17 and Sept. 19-21. Director: H. Steffen, Gebenerstrasse 18, Frankfurt a-O.

May 23-26. Magdeburg. — 25th show and sale of horses and exhibition of agricultural machines, with show of sheep, sheep-dogs and poultry.

Hungary.

September. — The sale and show mentioned in *B.* March 1914, p. 325, has been put off to September.

Italy.

Autumn. Vercelli (Piedmont). — Competition for mechanical cultivation of rice-fields, organized by the "Stazione Sperimentale di Risicultura".

Rumania.

May. Bukarest. — Agricultural show with competition for motor ploughs.

Russia.

May 20-June 7. Warsaw. — International show of agricultural machines with internal combustion engines, organized by the Central Agricultural Society of Poland.

Union of South Africa.

Agricultural shows: May 6-7, Hooptad (Orange Free State); May 22-25, Pretoria; June 11-12, Pietersbury (Transval); July 7-10, Durban.

United Kingdom.

June 30-July 4. Shrewsburg — Royal Agricultural Society's Show.

July 7-8. Cork. — Munster Agricultural Society's Show.

July 21-23. Newport (Mon.). — Welsh National Agricultural Society's Show.

Nov. 19-21. Norwich. — Fat stock show of the Norfolk and Norwich Christmas Show Association.

Dec. 7-11. Islington. — Fat stock show of the Smithfield Club.

Agricultural Congresses.

France.

May 29-June 1. Biarritz. — 18th Congress of the "Amis des Roses, Société française des Rosiéristes". M. Hurn-Sentouré, general sec. of Société d'Acclimatation, Biarritz.

Sept. 4-6. Lyons. — Annual congress arranged by the "Union nationale des Soci d'horticulture de France". Special subject: fruit-growing and the fruit tra M. Charles Balter, sec. of the Union, Faubourg de Croucels, Troyes.

Sept. 7 (opening). Grenoble. — Pomological Congress, organized by the "Société l mologique de France".

CROPS AND CULTIVATION.

304 – **The Frequency of Low Temperatures in the Sudan and its Effect on t Cotton Crop.** — HURST, H. E. in *The Cairo Scientific Journal*, Vol. VII, No. pp. 265-268. Giza, December 1913.

During the season 1910-11, a very poor cotton crop was obtained Atbara; this was attributed to the low temperatures experienced in the mo ths of November and December. The actual temperatures registered we 12 readings of 11° C. or lower, while in ordinary years only about 4 such l readings are registered, so that the damaging limit lies probably betwe 4 and 13 occurrences of 11° C. or lower. The writer tabulated the frequenci of low temperatures (11° C. or lower) registered at various points in t Sudan during the years 1902-1912, and then calculated the probability the occurrence of 8 or 9 such low temperatures in one year at these differe points. He points out that the results are only approximately corre as the available records only cover a small number of years, also that mo research is required as to the actual temperature conditions required damage the cotton crop; but, assuming that low temperature alone w responsible for the damage to the cotton crop at Atbara in 1910, the resul indicate that cotton cannot be grown in the neighbourhood of Atbara a Dueim without considerable risk, while at Khartoum the risks are less, thou further investigations are required to define them exactly; but at W Medani, Kassala and Tokar there seems to be little danger from ot weather.

An accompanying chart shows that the dividing line between safe a doubtful districts seems to follow roughly the isotherm of mean minimu temperature for the time of year of 16° C. Consequently, before mo cultivation is commenced in the Western Gezira, the exact effects of l temperature on the growth of cotton should be investigated.

305 – **Rainfall and Spring Wheat.** — BLAIR, T. A. in *Monthly Weather Rev* Vol. 41, No. 10, pp. 1515-1517. Washington, October 1913.

The influence of rainfall on the yield of spring wheat is estimated calculating the departure from the normal of the annual yields, and of t rainfall, during the months of May and June, for the 22 years 1891-19 The data refer to the States of Minnesota, North Dakota, and South D kota, and the results indicate that while the rainfall during the growi season is the chief determining factor with regard to the wheat yield in t two Dakotas, this is probably not the case in Minnesota, where much the land is badly drained, and the best crops are obtained in years wh the precipitation is normal or slightly subnormal.

- Relation of Precipitation to Tree Growth. — STEWART, M. N. in *Monthly Weather Review* (*U. S. Dep. of Agr.*), Vol. XVI, No. 9, p. 1287. Washington September 1913.

The width of the rings in an oak stump was measured and compared the rainfall records of the district over a period of 75 years. June and appear to be the two months whose rainfall is most closely connected tree growth; considering only the precipitation of these two ths, practically all rings more than 10 per cent. below the average h were formed in years of subnormal rainfall, while 62 per cent. of the above the average width correspond with years when the rainfall was e the average.

. Recent Studies of Snow in the United States. — CHURCH, J. E. Jun. (University of Nevada) in *Quarterly Journal of the Royal Meteorological Society*, Vol. XL, o. 169, pp. 43-52. London, January 1914.

A description of the instruments used by the writer in surveys, and s methods of working, together with some observations on the relation ountains and forests to the conservation of snow, the principal results hich have already appeared in this *Bulletin* (1).

- On a New Method of Measuring the Capillary Lift of Soils. — LYNDE, C. J. nd DUPRÉ, H. A. in the *Journal of the American Society of Agronomy*, Vol. V, o. 2, pp. 107-116. Lancaster, Pa., April-June, 1913.

Small glass funnels (4 cm. in diameter across the top) were fitted with n cloth filters, cut in the form of a circle 2 cm. in diameter and folded filter paper. Soil samples were boiled in water, and a little of the hot ure was poured on to the filter, the funnel was placed in a centrifuge already containing water, and centrifuged, the process being repeated he layer of soil settled on the filter reached well above the edges of otton cloth fibres. The lower end of each funnel was then connected a vertical capillary tube filled with water, the other end of the tube ng into a basin of mercury, so that the whole constituted a continuous column from the lower surface of the soil layer to the surface of the ury. As water evaporated from the upper surface of the soil, the ury rose in the capillary tube and the *capillary lift* could be measured. bsoil containing 74 per cent of clay and various soil fractions were d as follows: (Table I).

The theoretical capillary lift was calculated for the different soil ions, and in all cases except the clay fraction, the observed values fell een the limits of the calculated values. In the case of the clay, the calued value surpassed 34 feet of water or the height of a column supported e atmosphere. Some soils that were tried also gave higher calculated s than 34 feet of water, and in all these cases the observed values ined below the 34 feet. From this, the writers concluded that the press- the atmosphere limited the capillary lift which could be observed, and fore, that if the pressure were increased, it would follow that the capil

1) See No. 462, *B.* May 1913.

TABLE I.

Soil	Diam. of soil particles	Capillary lift	
		Mercury column	Equivalent water column
	mm.	cm.	feet.
Subsoil containing 74 % of 'clay'	—	67.5	30.1
Sand (medium)	0.5–0.25	2.2 2.1	0.98
Sand (fine)	0.25–0.1	4.0 3.9	1.78
Sand (very fine)	0.1–0.05	9.1 8.8	4.05
Silt	0.05–0.005	22.4 21.3	9.99
Clay	0.005–	60.1 55.9	26.80

lary lift would be increased too, and vice versa. To this end the apparatus described above was enclosed in a glass case where the pre could be controlled, and, working with clay the following results obtained : (Table II).

TABLE II.

Pressure cm. of mercury		Capillary lift, cm. of mercury
76	Normal	55.9
76	Pressure	60.1
99.5		86.3
104.2		78.4
61.3		56.3
56.3		44.3

The writer points out that one of the great advantages of this method of measuring the capillary lift is the rapidity with which obs tions may be made. In the experiments on the subsoil given in Ta the lift of 30.1 feet took place in 20 hours.

309 – **On Osmosis in Soils: The Efficiency of the Soil Constituents as permeable Membranes.** — LYNDE, C. J. and DUPRÉ, H. A. in *the Journa American Society of Agronomy*, Vol. V, No. 2, pp. 102-106. Lancaster, Pa., June, 1913.

In previous investigations (1), it has been shown that a clay subsoil trifuged into a dense layer about 2 inches thick, or more, in the bottor

(1) See No. 645, *B.* June 1913.

der, acts as a semi-permeable membrane whose efficiency varies with lepth of the column of clay. In the present paper, the efficiency of arious soil fractions to form this membrane was tested with the follo- results:

Soil fraction	Diameter of particles	Depth of soil column	Osmotic pressure per sq. cm.	Resistance of solution	Efficiency of soil column compared with a perfect semi-permeable membrane
	mm.	cm.	gms.	ohms.	per cent.
(medium)	0.5 –0.25	7	0	—	—
(fine)	0.25 –0.1	7	0	—	—
(very fine)	0.1 –0.05	7	0	—	—
. . . . .	0.05 –0.005	8	0.2	850	0.07
. . . . .	0.005–0.001	6.5	4.4	1 400	2.6
lay.	0.001–	5.5	42.0	1 500	27.1
remaining in sus- ion for a week . .	—	6.0	315.0	—	—

The efficiency increased as the size of the particles diminished, and, fractions made up of particles over 0.05 mm. in diameter were quite ctive, that consisting of particles which had remained in suspension week had already reached an osmotic pressure of 315 gms. per sq. cm. the article went to press, and the pressure was still increasing. The ons used were clay subsoil solutions.

Estimation of the Surface of Soils. — HANLEY, J. A. (Rothamsted Experiment ation) in *The Journal of Agricultural Science*, Vol. VI, No. 1, pp. 58-62. Cambridge nuary 1914.

An investigation into the possibility of estimating colloids in soils eans of dye solutions.

Three soils were selected which contained 3 per cent, 8 per cent, and r cent of clay respectively, and 12 solutions of methyl violet were red varying in strength from 0.25 gms. to 3 gms. per litre. Five grams dry soil were shaken up with 100 cc. of each solution, and left in ct for 48 hours, then part of the top solution was pipetted off, diluted ly, and the dye estimated colorimetrically by means of Nessler tubes standard dye solution. The amount of dye absorbed per 100 dry as calculated, and plotted against the concentration of the final on.

The results yielded three curves which show that when compared basis of the concentration of the final solution instead of that of the al solution, the ratio between the amounts of dye absorbed by the soils remains practically constant for various concentrations, and is

equal to 0.74 : 0.86 : 1 for the soils containing 3, 8, and 20 per cent of c respectively. In other words, to obtain relative values indicating the act surfaces of different soils, it is necessary that each soil be brought i equilibrium with a solution of the same strength, and as some soils abs more dye than others, a solution of different strength must be used each soil.

The writer adopted a standard equilibrium solution of 0.05 per cent, is continuing his investigations as the method is simple and likely to pr useful as an index of certain physical qualities in soils.

311 – **The Humus of Acid and Alkaline Peats.** — HANLEY, J. A. (Rotha Experiment Station) in *The Journal of Agricultural Science*, Vol. VI, No 1, pp. 6 Cambridge, January 1914.

A collection of peats, received atthe Rothamsted Laboratory from ious parts of England was investigated with a view to establishing a cl ical distinction between the different classes of such soils, and more es ially between the alkaline or normal peats and the acid peats.

In 35 soils the humus was extracted with 4 per cent ammonia b and after treatment with $\frac{N}{5}$ hydrochloric acid, and the results showed a soil might be alkaline, and yet have a considerable amount of its hu soluble in ammonia without previous acid treatment. In a numbe calcium carbonate determinations carried out simultaneously, no acid to litmus contained carbonate, while all the alkaline soils did.

Five soils were then selected for more detailed study along the fol ing lines : the nitrogen was estimated in the ammonia extracts obta before and after acid treatment, and in similar extracts made with a solution of equivalent strength to the 4 per cent ammonia ; the proteins hydrolysed with 20 per cent hydrochloric acid and the ammonia formed was estimated; finally the soils were boiled in a sucrose solu and the amount of sugar inverted was estimated. At the same time v cultures were carried out where the only source of nitrogen to the p was supplied in the form of the peat itself added to each bottle.

Of these various methods of comparison : the alkaline extracts yield safe guide to the acidity of a soil though soda gave more significan sults than ammonia in this respect. Neither was the hydrolysis of pro of any use in discriminating between peats, the yield of ammonia wi per cent hydrochloric acid being very low in normal peats, and nil in peats. On the other hand, the inversion method apparently yielded ful results which agreed closely with the general characteristics of the p and this method of comparison was extended to a number of other peat The reaction being one in which neutral compounds cannot taken and depending on the concentration of the acid present, the alkali normal soils always gave lower results than acid soils, and treatment 5 per cent hydrochloric acid invariably led to an increase of the inve power of a soil though every precaution was taken to get rid of the last of hydrochloric acid. Moreover normal fertile soils, which would be exp

ıntain a large proportion of their organic matter as available humus, ys gave more " total inversion " than acid soils.

- The Solution and Precipitation of Iron in the Formation of Iron Pan. — MORISON C. G. T. and SOTHERS, D. B. (School of Rural Economy, Oxford) in *The Journal of Agricultural Science*, Volume VI, Part I, pp. 84-96. Cambridge, January, 1914.

The formation of iron pan, or Ortstein, which is of fairly frequent oc- ɔnce in Europe, has been accounted for by three different theories. ɪrding to the first and second theories, the phenomenon is due to the nate reduction and oxidation of iron compounds — humates in the ɔase, and oxides in the other — the reduction being brought about by ɪrganic matter in the peat, and being followed by the solution, washing ı, and subsequent oxidation and re-deposition of the iron compounds ıe pan level. The third and more modern theory considers the formation n to be due to colloidal humus compounds of iron and aluminium which ɔarried down into the soil and there precipitated by soluble salts, by of water, or by change of bases. The experimental evidence in sup- of this last theory did not appear conclusive, and for this reason the ɪrs re-examined the subject.

They worked with iron compounds, as both the ferrous and the ferric yield very delicate tests.

n a preliminary set of experiments in which soil, ferric oxide or powdered ıite was boiled with peat and various reagents, it was shown though the peat had a strong reducing action on any iron salts present, d no direct action on ferric oxide itself, unless some body capable of ɪing small quantities of iron into solution were present. As ammonium ide was apparently the most efficient reagent for this purpose, it ed possible that ammonium salts present in peat might play some part ding the solution of ferric oxide in the soil, especially as, on analysis, ımmoniacal nitrogen of a series of peats proved in most cases very ; times greater than that found in ordinary soils.

A second series of experiments was therefore carried out, in which preci- ed ferric hydroxide was shaken up 1) with water containing carbon de, 2) with humic acid, 3) with both these substances, and 4) with am- ım chloride in addition; in other bottles, soil was shaken with peat carbon dioxide water, with and without ammonium chloride. ıer at ordinary room temperature not at 20° C. could any ferrous ric reaction be detected in the solution; under these circumstances, fore, the ammonium chloride had no effect in bringing iron into solution. But when these same solutions were evaporated to dryness gnited, and the residues were redissolved in hydrochloric acid, the ion for ferric iron was obtained, showing that the original solution have contained some iron in the form of a complex ion or a colloid sol. In a further set of experiments an attempt was made to measure the nt of iron thus removed. The results, though not very reliable, con- d the evidence obtained previously, in that conditions which would ase or decrease sol formation also increased and decreased the amount n present.

Again, a solution of ferrous humate was prepared by heating gether peat, distilled water and iron filings; the solution obtained ga strong ferrous precipitate with potassium ferricyanide. When oxidised hydrogen peroxide, a slight brown precipitate was formed; on filte this off, the resulting solution, though it gave no reaction for ferro ferric iron was shown to contain a colloidal sol of iron, similar to thos tained before. Whether this is a colloidal sol of true ferric humate colloidal absortion complex of colloidal humus and colloidal ferric hyd is not yet clear.

Lastly, on analysing the residue of a solution containing such a co suspension extracted from a soil, it was found to consist mainly of aluminium and calcium, with traces of magnesium, showing that alumi and calcium are also involved in the formation of the pan.

The writers follow out the process of pan formation according t evidence obtained in their experiments, as follows: one of the first re of the accumulation of the surface layer of peat is the production of stances showing acid properties, which will remove the more readily atta constituents of the soil — probably in the state of true solution. A same time there are formed colloidal humates of iron, aluminium calcium, but, owing to the fact that the soil solution is at first comparat concentrated, these colloids are probably in the gel form, and are not rem from their original position. When the soil solution has become ficiently dilute, the gels assume the sol form, and are removed fro layer which ultimately becomes the bleached sand layer lying immedi under the peat (*i. e.* go into suspension in the soil solution). This o during the wetter part of the year. As the soil dries up, the wate cedes from the surface, and the major part of the colloidal suspens taken with it. As desiccation proceeds, the soil solution becomes concentrated with respect to the colloid, and deposits more ferric hum the lower level, and, owing to the negligible osmotic pressure of the c sol, little diffusion will take place. Consequently desiccation will be rapid than diffusion, and the whole of the material in suspension w deposited. When the wet season recurs, the coagulated and desic colloids will not entirely go back into suspension, as the colloid cha may well have been changed during the process of desiccation.

It is conceivable that some of the the iron bacteria may play a part i formation of the pan, but the writers consider that it is possible to ac for its formation without the intervention of living organisms.

313 – **Ferrous Iron in Soils**. — MORISON, C. G. T. and DOYNE, H. C. (Sch Rural Economy, Oxford) in *The Journal of Agricultural Science*, Vol. VI, pp. 97-101. Cambridge, January 1914.

The writer shows that the present methods of estimating fe iron in soils are quite unsatisfactory. They consist essentially in the dilute acid as a solvent, and of subsequent titration with potassium perm anate. As has been shown previously (1), soils boiled with such

(1) See No. 312 *B*. April 1914.

ids, in presence of organic matter, have their ferric salts reduced to fer-
us, therefore the amount of ferrous iron estimated depends on three inde-
ndent factors :

1) The amount of ferrous iron present,
2) » » » soluble ferric iron present,
3) » » » organic matter present.

- **The Nature and Amount of the Fluctuations in Nitrate Content of Arable Soils.** — RUSSELL, E. J. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VI, No. 1, pp. 18-57. Cambridge, January 1914.

Systematic determinations of the nitrate content of soils were carried
t during the four years 1909-13, the results of which are brought together
the above paper. The soils studied varied from sands to clays, and they
re sampled to a depth of 18 inches in two layers (0—9 in. and 9—18 in.),
:h layer being considered separately.

The results disclose the remarkable fact that the accumulation of ni-
tes in the soil takes place most rapidly in late spring or early summer
ays, June, July), and not in the late summer as in often stated, the actual
iod of the rise varying with the character of the season, being earlier
er a dry cold winter than after a wet mild one. Subsequently to this
umulation, the nitrate content appears to depend partly on the nature
the soil and its treatment, and partly on the season. On fallow land,
re is usually little, if any, subsequent gain, and frequently a loss,
in the hot, dry season of 1911 the accumulation continued on some soils
it on till September.

The maximum nitrate content of the soils rarely exceeded :

6 parts of nitrogen per million of dry soil, or 28 lbs. per acre for a sand,
23 » » » » » » » » 115 » » » » » loam,
(excepting on heavily dunged land when it rose to 37 parts per million)
14 parts of nitrogen per million of dry soil or 60 lbs. per acre for a clay.

Loams showed greater fluctuations in nitrate content than either clays or
ds. Clays lost less nitrate in winter, but also accumulated less in June
July, while sands were reduced to the same low level as the loams in
ter and never accumulated much in summer. The rainfall during the
ter greatly affected the amount of nitrate lost by loams and sands,
et autumn or winter proving very disastrous, and much evidence was
umulated in this connection to show that all winter losses of nitrate
due to leaching rather than to denitrification.

On cropped land, the nitrate content was always lower during the late
mer and early autumn than on corresponding follow land, even after
wing for the nitrogen taken up by the crop. In fact no evidence could
)btained that any nitrate was being produced during the time of active
it growth in the hot summer of 1911, although nitrate accumulation
taking place on adjacent fallow land. In some cases the nitrate content
again after harvest. Moisture determinations and temperature
lings on fallow and cropped soils only showed small differences, but it

is impossible to say how far these reacted on the rate of nitrate production. Other observers have noted this same phenomenon of a reduced nitrate content on cropped soils in such dissimilar localities as India, New York State, and Paris, but no solution is at present suggested to explain the results.

The investigation included a study of variously manured plots; ammonium salts nitrified more or less rapidly and completely according to the season and the time of application. Ammonium salts applied in February 1909 were not completely converted at the end of 7 weeks, but another dressing applied in April was completely nitrified in 4 weeks. With regard to the residual effect of ammonium salts, plots habitually receiving annual dressing of ammonium salts contained more nitrates than similar unmanured plots, though none had received dressings in the actual year of the experiment; but when the matter was investigated on two Broadbalk wheat plots which received ammonium salts in alternate years, no evidence of residual nitrogen was obtained.

The writer points out that the general conditions favouring nitrate accumulation are also those favouring crop production. He tabulates two sets of Rothamsted experiments which show clearly the depressing effects of wet winters on crop production, and how intimately this is connected with the leaching out of the nitrate. He further remarks that it is important that agriculturists should realise what great accumulations of nitrate occur in the soil at the end of a dry summer, and how complete may be the loss on loams and sands during a mild, wet winter: 50 lbs or more of nitrogen per acre may easily be lost while the land lies bare between harvest and seed time, and this amount is all that is taken out of the soil by a 32-bushel wheat crop. As time goes on and the price of nitrogen manures rises, the problem of reducing winter losses of nitrate is likely to increase in importance, and it is now being attacked by experiments in green manuring.

Results obtained by Leather at Pusa, and Jensen in South Dakota, are discussed in their bearing on the present investigation; they support the general rule that when a period unfavourable to nitrification comes to an end, and more favourable conditions set in, the rate of nitrate accumulation tends to be more rapid in the early part of this new period than later.

Though other investigators have suggested other reasons for the phenomenon, the matter is readily explainable on the view that the soil population is complex and includes two groups of organisms, one of which is engaged in the production of plant food, while the other is detrimental and somewhat more readily put out of action by adverse conditions.

The method of estimating nitrates at the Rothamsted Laboratory is given in detail. It consists of reduction by means of a zinc-copper couple and has yielded very reliable results over a large series of trials.

315 – **The Effect of Heat on Hawaiian Soils.** — KELLEY, W. P. and MCGEORGE, in *Hawaii Agricultural Experiment Station, Bulletin* No. 30, pp. 5-38. Washington D. C., December 1913.

Hawaiian soils are characterised by: 1) the peculiar properties of a high percentage of the clay; 2) the inertness of the unploughed and un-

en sod lands. A field ploughed for the first time, even when reduced to state of fine tilth, usually will not support plant growth satisfactorily, that local farmers find it necessary to aerate newly ploughed lands r a period of several months before planting the first crop.

Heat, however, appears to be able to accomplish the effects of aeration, since excellent growth of crops is obtained on plots where brushwood as been burned, even when applications of fertilisers are unsuccessful.

In these experiments, twelve different soils representing a wide range types and agricultural conditions were studied with reference to the effects heating to 100° C., to 250° C. and to ignition. The solubility of all e mineral constituents, except soda, was determined, using water and nitric acid as solvents. A study of the changes that take place in the dividual nitrogen compounds was also made.

The results showed considerable variation with regard to the absolute d relative solubility of the inorganic constituents in the different samples. ying at 100° C. was found to bring about an increase in the water-soluble nganese, lime, magnesia, phosphoric acid, sulphates and bicarbonates. e solubility of potash silica and alumina was increased in about half e soils examined, but in some cases it was decreased, while the solubiy of iron was decreased in most cases.

Heating to 250° C. or ignition produced effects similar to those brought out at 100° C., but varying in degree, being sometimes greater and netimes less.

The solubility in nitric acid was not greatly affected by heating to 0° C., but in some instances heating to 250° C. considerably increased the ubility of alumina, manganese, potash and phosphoric acid, and, at the ne time, effected a reduction in the solubility of lime and magnesia. on ignition, the solubility of alumina, silica, potash, phosphoric acid d sulphates was increased, while the solubility of lime and magnesia derwent a corresponding decrease.

The solubility of the constituents of soils used in aquatic agriculture bnormally high, but on drying out it becomes more similar to that of ated soils. When such soils are heated after drying, they seem to unergo changes of the same order as those produced in dry-land soils.

The most important factors affecting the solubility of soil constituents believed to be of a physical nature, and are attributed to the behaur of colloidal films adhering to the soil particles. The more important tors of a chemical nature are the deoxidation of manganese dioxide, dation (particularly of iron), double decomposition and dehydration. high temperatures bicarbonates become converted into carbonates, s effectively lowering the solubility of lime and magnesia.

With regard to the nitrogeneous constituents, nitrates undergo deposition at 150° C., being practically totally destroyed at 250° C., le ammonia is formed in abnormally large amounts at 200° C. Soil ch had been subjected to burning in the field was found to undergo stilated ammonification after heating. Nitrification on the other hand not restored after the lapse of two months. Heating to 200° C.

caused a loss of approximately 25 per cent. of the total nitrogen. Th loss of nitrogen, and of the ammonia formed by the action of heat, can largely from the monamino-acid group, and to a less extent from th amides and diamino-acids.

316 – **The Rice Soils of Hawaii.** — KELLEY, W. P. in *Hawaii Agricultural Experiment Station, Bulletin* No. 31, pp. 3-23. Washington, D. C., January 1914.

The rice soils of Hawaii are typical laterites, and in mechanical comp sition resemble clay loams with a rather high organic content. The cl is not composed of kaolin, but consists of ferric and aluminium hydrat with double silicates of iron and aluminium. Chemical analysis sho that they are generally rich in nitrogen and phosphoric acid but po in potash.

Manurial experiments showed that the best results are obtained using ammonium sulphate as fertiliser. Organic nitrogenous manures gi better results if applied sufficiently early to enable decomposition to beg before planting the rice. Nitrates may produce a decrease in the cr owing to the formation of poisonous nitrites.

Experiments on the rate of ammonification of dried blood in so of varying moisture content show that it increases steadily with increa in moisture content, reaching a maximum at about two-thirds saturati after which it declines somewhat; but at complete saturation it is sufficient rapid to supply the needs of the rice plant.

A rotation of crops whereby a legume is ploughed in between the cr of rice is believed to be the best system for this cultivation.

317 – **Eradicating Water Weeds from Irrigating Ditches.** — *Engineering Ne* Vol. 69, No. 2, p. 40. New York, January 10, 1914.

Disking canals while the water is running is reported as a success means of eliminating growths of water weeds in the Bear River and Ca valley projects in California. An ordinary disk harrow is stripped of seat and double trees and the tongue is cut 4 ft. in length. To this hitched two ropes, leading to teams, one on each bank; by adjusting the len of these ropes the harrow can be run on either slope or on the bottom. T digs up the roots and the plants float down and are removed. The ab canals were very foul three years ago when Mr. Whelan, the manager, troduced this system; now very few weeds are left. It is cheaper th mowing and it does not interrupt the flow of water.

318 – **The Balance of Fertilizers in the Soil.** — HOFFMANN M. Statische Un suchungen. — *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 251. Berlin,

The aim of agricultural statics is to carry out a continued chemical c trol of the content of plant food in the soil under different rotations, o other words, statics teach the way of establishing equilibrium between supply and consumption of plant food in the soil. Its systematic appli tion can be of great assistance in determining the manure requirement

l. Of late years, however, opinions as to the value of statics differ very h, not only among scientists, but also among practical farmers.
In Germany the science of statics has been, and still is, advocated and tised by two eminent practical farmers: Schultz of Lupitz, first president ie section for manures of the Deutsche Landwirtschafts-Gesellschaft, his successor Vibrans of Calvörde (1). Schultz-Lupitz unfortunately ished the balance of five years only (1879-84), while the records of 'alvörde farm embrace a much longer period. Vibrans has, probably than anybody else, shown great perseverance in the study of the eco- cs of plant food in the soil, for part of his entries reach back to 1868 and ontinued most conscientiously up to the present for some fields, espe- on sandy or moor soil, so that the material he has accumulated covers riod of upwards of 40 years. These figures have been completely rated by the writer of this paper. With the object of verifying the ons of Schultz and of Vibrans on the value of soil statics, he has added ir figures which he calculated on the data of records of five farms, the ing of which was yearly checked by the Book-keeping Office of the Deut- Landwirtschafts-Gesellschaft. The figures for these farms unfortu- y embrace a period of only five years; 1907-12. It was not possible ablish the statical account for each field as only the totals of the were entered. As for the several farms, all the characteristic details the writer could collect have been described in the text that prece- ach table. The figures concerning Herr Vibrans' farm are drawn his plant-food register.
n the case of Leguminous plants for fodder or pulse the nitrogen was onsidered.
'hese tables afford a comprehensive view of the changes in the amount nt food in the various fields during the course of years. One of them oduced in the accompanying table.
'ibrans has collected similar figures, though partly for shorter periods, l the fields of his farm.

(1) See *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 76. Berlin, 1902. (*Ed.*).

Balance of Fertilizers on Calvörde Farm. — Field of 37.

Year	Applied in manure			Crop	Yield
	K_2O	P_2O_5	N		
1868	94	36	79	Potatoes	11 000
1869	—	36	14	Rye	1 390
1870	94	36	79	Potatoes	5 350
1871	—	36	14	Rye	1 370
1872	108	40	94	Potatoes	11 240
1873	—	45	14	Rye	1 270
1874	—	—	—	Clover and lupins	360
1875	140	88	128	Rye	1 490
1876	108	40	94	Potatoes	11 060
1877	94	47	106	Rye	1 740
1878	—	72	—	Peas and clover	2 490
1879	—	18	14	Rye	1 740
1880	126	43	108	Potatoes	9 460
1881	—	54	7	Rye	1 430
1882	108	13	54	Potatoes	16 400
1883	45	45	13	Rye	1 600
1884	140	47	209	Potatoes	17 800
1885	45	54	14	Rye	1 250
1886	140	47	209	Potatoes	17 800
1887	68	65	—	Peas	1 530
1888	68	65	—	Rye	1 200
1889	113	65	155	Mangolds	26 800
1890	113	32	29	Oats	2 500
1891	113	32	29	Rye	1 070
1892	234	65	79	Mangolds	28 500
1893	112	—	29	Oats	660
1894	95	36	135	Potatoes	19 300
1895	—	32	27	Mangold seed	1 890
1896	81	32	—	Rye	1 350
1897	135	45	180	Sugar beets	24 600
1898	—	32	—	Peas	1 500
1899	288	72	234	Potatoes	21 400
1900	—	27	13	Mangold seed	1 610
1901	72	36	27	Barley	920
1902	108	45	108	Potatoes	18 700
1903	56	36	31	Barley	1 500
1904	108	50	—	Rye	1 160
1905	83	97	29	Rye	1 600
1906	76	56	56	Rye	1 470
1907	76	54	54	Rye	1 530
1908	126	54	56	Rye	1 710
1909	81	59	40	Rye	1 430
1910	180	94	94	Mangolds	28 500
1911	72	49	61	Rye	890
1912	—	—	27	Rye	1 360
In 45 years: total	3700	2027	2743		
In 45 years: as dung	1906	673	1968		
In 45 years: as chemicals	1794	1354	775		
Yearly: total	82	45	61		
Yearly: as dung	43	14	43		
Yearly: as chemicals	39	31	18		

humous sandy soil. (All figures in lbs. per acre).

	Year's balance			Total balance		
N	K_2O	P_2O_5	N	K_2O	P_2O_5	N
72	+ 29	+ 11	+ 7	+ 29	+ 11	+ 7
38	— 34	+ 16	— 24	— 5	+ 27	— 17
31	+ 63	+ 25	+ 48	+ 58	+ 52	+ 31
38	— 34	+ 16	— 24	+ 24	+ 68	+ 7
72	+ 43	+ 15	+ 22	+ 67	+ 83	+ 29
34	— 31	+ 27	— 20	+ 36	+ 110	+ 9
—	— 36	— 18	—	± 0	+ 92	+ 9
38	+106	+ 68	+ 96	+ 106	+ 160	+ 99
72	+ 43	+ 15	+ 22	+ 149	+ 175	+ 121
50	+ 49	+ 20	— 56	+ 198	+ 195	+ 177
—	— 45	+ 47	—	+ 153	+ 242	+ 177
50	— 45	— 7	— 36	+ 108	+ 235	+ 141
61	+ 72	+ 21	+ 47	+ 180	+ 256	+ 188
38	— 36	+ 34	— 31	+ 144	+ 290	+ 157
112	± 0	— 27	— 58	+ 144	+ 263	+ 99
47	+ 7	+ 22	— 34	+ 151	+ 285	+ 65
77	+ 12	+ 13	+132	+ 163	+ 298	+ 197
36	+ 14	+ 36	— 22	+ 177	+ 334	+ 175
61	+ 12	+ 13	+148	+ 189	+ 347	+ 323
—	+ 32	+ 43	—	+ 221	+ 390	+ 323
40	+ 36	+ 45	— 40	+ 257	+ 435	+ 283
88	— 76	+ 27	+ 67	+ 181	+ 462	+ 350
81	+ 54	— 9	— 52	+ 235	+ 453	+ 298
31	+ 84	+ 18	— 2	+ 319	+ 471	+ 296
95	+ 32	+ 24	— 16	+ 351	+ 495	+ 280
22	+ 96	— 9	+ 7	+ 447	+ 486	+ 287
67	— 35	+ 2	+ 68	+ 412	+ 488	+ 355
45	— 40	+ 14	— 18	+ 372	+ 502	+ 337
—	+ 49	+ 12	—	+ 421	+ 514	+ 337
81	— 9	+ 13	+ 99	+ 412	+ 527	+ 436
—	— 36	+ 10	—	+ 376	+ 537	+ 436
97	+126	+ 29	+137	+ 502	+ 566	+ 574
45	— 38	+ 5	— 32	+ 464	+ 571	+ 541
27	+ 50	+ 25	± 0	+ 514	+ 596	+ 541
85	— 34	+ 7	+ 23	+ 480	+ 603	+ 564
63	— 2	+ 4	— 32	+ 478	+ 607	+ 532
36	+ 77	+ 32	— 36	+ 553	+ 639	+ 496
47	+ 42	+ 75	— 18	+ 597	+ 714	+ 478
50	+ 31	+ 31	+ 6	+ 628	+ 745	+ 484
54	+ 29	+ 27	± 0	+ 657	+ 772	+ 484
50	+ 81	+ 29	+ 6	+ 738	+ 801	+ 490
61	+ 27	+ 30	— 21	+ 765	+ 831	+ 469
94	± 0	+ 45	± 0	+ 765	+ 876	+ 469
25	+ 50	+ 36	+ 36	+ 815	+ 912	+ 505
58	— 34	— 20	— 31	+ 781	+ 892	+ 474
2269				+ 781	+ 892	+ 474
50				+ 17	+ 20	+ 11

319 – **Manurial Experiments in the German Colonies** (1). — *Reichs-Kolonialamt. Düngungsversuche in dem Deutschen Kolonien*, Nos. 2, 3. II, and 4. Berlin, 1913 and 19

The above publications contain the results of further experiments c ried out in accordance with the resolution adopted by the Reichstag April 1911 (2).

Kamerun. — The soils in the mountainous zone — up to the present only one under cultivation — are of volcanic origin, and therefore of hi fertility. This, together with the fact that the native cultivators h never carried on an intensive form of culture, led to the belief that the s were inexhaustible, which is far from being the case. In fact the high ra fall (10 000-12 000 mm., or 390-470 in.) subjects the soil to serious leachi which is only partly counterbalanced by the considerable absorbent pow of the soils for nutrient materials.

Analyses of the soil do not indicate an especially high nutrient conte which remains within the following limits (per cent.) :

Nitrogen	Potash.	Phos. acid.	Lime	Magnesia
0.15–0.22	0.05–0.12	0.04–0.145	0.063–0.156	0.08–0.27

Existing plantations cover 70 000 acres, of which 50 000 acres are rub underplanted with cacao and the rest oil palms.

Nitrogenous manures are hardly needed, as the rapid decomposit of organic matter and the tropical rains, as well as the absorbent pow of the soils, tend to maintain the reserves of nitrogen. Potash is requi in large dressings, for not only are the soils poor in this substance but two crops, cacao and palms, remove considerable amounts in the be and nuts (1.3 per cent. and 0.5 per cent. of potash respectively). T same may be said for phosphoric acid. Lime is especially necessary in t pical agriculture, but must be used with considerable caution as it may oth wise lead to soil exhaustion, and in this connection it may be mention that the Kamerun soils, being specially rich in magnesia, should prov good material for investigating the question of Loew's lime-magn ratio. Humus is usually deficient in tropical soils and should be increased the use of all crop refuse and by green manuring.

Fertilizers are beginning to be appreciated by planters, and the impo rose from 22 tons in 1907 to 1450 tons in 1912.

In order to establish a rational system of manuring, the Agricultu Experimental Institute at Victoria has organised a series of manurial tr based on the system adopted by the German Agricultural Society, modified according to local requirements. Thirty-two series were runn in 1911-12 and these were increased to 47 in 1913, embracing the follo ing crops : cacao, Funtumia, Hevea, manihot, oil palm, bananas, toba maize, cotton, earthnuts, sweet potatoes, pine apples.

Togo. — Agriculture being chiefly in the hands of native cultivato manurial trials have been carried on in their plantations in the hope

(1) See No. 480, *B.* May 1913; No. 1250, *B.* Nov. 1913; No. 11, *B.* Jan. 1914.
(2) See No. 480, *B.* May 1913.

tually inducing them to use fertilizers; other trials have been carried
o at the Government stations and on private plantations. In 1913,
series of trials were running, distributed over the following crops: cot-
maize, sisal, cocoanut, oil palm, cacao, coffee, rubber, kola, sweet
oes, beans, sorghum, vegetables.
In an appendix the general plan of the experiments is given. Each
consists of five plots receiving so-called "differential" treatment,
s carried out in duplicate. Particulars are also given of the dressings
ed to the principal crops, of the area of the plots, and of their treat-

erman East Africa. — From the results of the experiments begun in
(1) it would appear that the application of fertilizers has a good effect
e crops obtained, but more data are required to confirm these
s. The plan originally laid down for the experiments has proved
satisfactory and has not required to be modified in any way, but a
staff is urgently required in order to carry on the work more
ually.

erman New Guinea. — Notwithstanding their origin from recent
nic material, the soils exhibit a relatively low potash content, from
it would appear that there must exist a factor impoverishing the soils
s respect; phosphoric acid is high and nitrogen rather low. In 1912
were 80 000 acres under cultivation in the Protectorate (including the
s); of this area, 73 000 acres were under coconuts, 26 700 acres being
ring. Other plantations consist of rubber and cacao, and the starch-
ing plants of the natives, the latter being very exhausting crops.
uts too, remove large quantities of mineral matter from the soil: with
ms to the acre, an annual production of 2400 coconuts per acre would
e:

potash	71 lbs.
nitrogen	11 »
phosphoric acid	6 »
lime	6 »
magnesia	4 »

p to the present manuring has been confined to the application of
or to green manuring with *Crotalaria striata*, *Tephrosia purpurea* or
Leguminous plants, but more complete manuring is necessary not
or increasing the crops but also for making them more resistant to de-
The extended use of fertilizers will, however, be impeded by the high
f transport.
he Government started 32 series of trials in 1912-13 and increased
to 35 for the season 1913-14, distributed over the following crops:
its, rubber, cacao, coffee, bananas, maize, sorghum, sweet potatoes,
c, earthnuts, castor oil, *Paspalum dilatatum*, pineapples and vege-

See No. 480 *B.* May 1913. (*Ed.*).

tables. The experiments were carried out on the same lines as t mentioned above in connection with Togo.

Samoa. — The soils are of variable fertility, notwithstanding their mon basaltic origin, and, according to the analyses of Woltmann, po a high content of nitrogen, phosphoric acid, magnesia and iron and a erate to low content of lime, but are deficient in potash.

Twenty-three series of manurial trials were started in 1912-13 an creased to 32 the next season; they deal with the following crops: c coconuts, rubber, taro, lucerne, pasture, bananas, maize, tobacco, apples, vegetables.

The first experimental results obtained with taro (*Colocasia antiqu* are of special interest, as it is the chief native crop and the prin article of diet of the Samoans. Being an exhausting crop the native pra is to move on to a fresh piece of ground when the soil is worn out. Wit usual manurial dressings, it was found that, though the experimental had previously been under cacao, crops of tubers were obtained equ those on virgin land. Moreover the formation of new tubers was gr stimulated, and the number of new shoots formed averaged ten per or twice the usual number, so that not only was the harvest larger the means of propagation were also increased. The new tubers were al as large as the mature tubers, which is not usually the case, and shoots were so well developed that they could be transplanted witho periencing a set back. The new tubers being more abundant, five cou left in the soil in the place of the usual two, and thus the crop increased.

An appendix to this report contains detailed instructions for car out the experiments as well as the arrangement of a book for reco results.

320 – **The Influence of Catalytic Substances on Crop Yields.** — RIVIÈRE, BAILHACHE, G. in *Journal de la Société Nationale d'Horticulture de France*, Vol pp. 782-788. Paris, December 1913.

In 1906, applications of ammonium vanadate, sodium borate, so fluorate, and sodium arsenate increased cereal crops 10 per cent., salts of lithium, caesium and rubidium had a still greater effect on a crop. During the next three years, rubidium salts alone were tested in two out of the three years marked increases in the yields were obta The soil on which the experiments were carried out was a loam resti clay.

321 – **Phosphate Beds in Egypt.** (1) (Note sur l'industrie minière en Egypte, par le Département des Mines-Phosphates). — EGYPTE, MINISTÈRE DES FIN *Annuaire Statistique de l'Egypte*, Year V, p. 583. Cairo, 1913.

The Egyptian phosphate beds are very similar to those of Tuni Algeria, being widely distributed and forming altogether a very large They have been comparatively little investigated. As they are sit

(1) See No. 1246, *B.* Nov. 1913.

g way from the Mediterranean coast, those nearest to the other trans- routes were the first to attact attention, and the ones being worked esent are near either the Red Sea or the Nile Valley. These too, ac- ng to the available evidence, are the richest, and compare favour- with Tunisian and Algerian varieties. It is thought that it will be pos- to increase the production of the richer salts containing 68 per cent. or of tricalcic phosphate and that the material will be exported to Europe. entire production of the " Egyptian Phosphate Co." for 1912 (60 000 was sent to Japan; this company works three mines near Safaja (Red Sea), where modern appliances have been erected for loading, and ht railway has been laid to connect the mines with the port. The ietà Egiziana per l'Estrazione ed il Commercio dei Fosfati" is also ing large areas at El-Kosseir on the Red Sea and at Sebaia on the Nile s erecting plant for export work.

Should the demand for phosphates be maintained, as there is every n to suppose from their increasing use, the future of the Egyptian try is very promising.

Influence of Radio-active Emanations on Vegetation. — STOKLASA, J. and DORNICKY, V. in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, l. 157, No. 22, pp. 1082-1084. Paris, December 1, 1913.

— *Cultures in Knop's solution containing radio-active water either ial or natural.*

he experiments were conducted at Franzensbad and Brambach near urces of the natural waters. The Brambach waters possess a strength o Mach units per litre, and those of Franzensbad about 100 to 150 Each culture was supplied with 70 Mach units of radio-activity nutritive solution. After two days, the activity of the solution had reduced to 52 units, after three days to 36 units, while after four days to only 19 units and had to be renewed. During the 23 days of the iment, each plant had received 350 units of radio-activity.

fter 23 days at a temperature of 18° to 20° C. the following results of y weight of the plants were obtained:

	Control	Radio-active
Lentils	3.7 grams	6 grams
Peas	9.7 »	21 »
Wheat	3.1 »	8 »

hus the radio-active water has increased the yields by from 62 to er cent.

he following results were obtained with buckwheat grown in soil for ys and supplied with solutions containing 30 and 60 units of radio- y every five days:

	Dry weight of 100 plants
Control	9.45 gms.
With 30 units	13.54 »
With 60 units	19.54 »

When the radio-activity was increased by giving 600 units every days, the growth of the plants was checked.

2. — *Pot cultures sprayed with artificial radio-active water.*

Experiments with poppies (35 plants) receiving a total of 2500 of radio-activity during a period of 108 days, gave the following res

	Dry matter		
	fruits	stems	total
	—	—	—
With radio activity	35.33 gms.	83.58 gms.	118.91 gms.
Control	16.25 »	63.08 »	79.33 »
Increase due to radio-activity	19.08 » or 117.4 %	20.50 » or 32.4 %	39.58

Lupins (48 plants) sprayed with water containing a total of 2000 gave the following results:

	Dry matter		
	seeds.	stems.	total
	—	—	—
With radio-activity	224.91 gms.	451.25 gms.	676.16 gms.
Control.	136.58 »	284.16 »	420.74 »
Increase due to radio-activity	88.33 » 65 %	167.09 » 59 %.	255.42 »

Thus spraying the plants with radio-active water increases the fer and the rate of maturity of the plants.

3. — *Pot cultures subjeted to radio-active emanations in closed ves 85 litres capacity.*

Experiments with field peas, maize, buckwheat, white mustard beets, grown in air charged with from 10 to 30 Mach units per litre, sh earlier flowering and more rapid maturity and increases in yield of 30 to 90 per cent over those of the control plants.

Large doses of radio-active emanations retard growth and appe give rise to toxic products.

323 - **Royal Hungarian Institute for Plant Breeding**. – *Communication from* M. GRABNER, *Chief of the Institute.*

The improvement of agricultural plants in Hungary has been tised for a considerable time, but owing to the faulty system followe sitive results have only been obtained during the last 10 years by the tion of systematic selection. Owing to the continental climate, it i possible to acclimatise the most important varieties of crops (espe wheat) produced in Western Europe, and it therefore becomes mor cessary in the interests of intensive culture to adopt measures for th provement of local varieties. Various isolated attempts had already made in this direction, and the necessity for coordination called for the tion of a State Station to render assistance to workers by means of pr sional advice, to reorganise and develop the methods of improvement to take up the improvement of the more important plants not selecte the agriculturists.

With this object in view, the Ministry of Agriculture established the
al Hungarian Institute for Plant Breeding. The work of organisation
begun in the spring of 1909 at Budapest and continued the following
at Magyaróvár, where the station was finally set up at a cost of £13 300
he land and buildings and £ 3 300 for equipment. The garden covers
y 2 acres and is close to the central building containing the offices and
atories. There is also a glass culture house for tender plants, 200 port-
culture pots and 140 pots sunk in the ground. The garden is used
he more valuable culture material under investigation, such as the first
s selection and hybrids. About 15 minutes' walk from the town, there
bout 50 acres of experimental fields for the trial of selected seeds
he multiplication of desired strains for adoption on a large scale. There
o a building containing a museum for the classification of products,
d depôt and rooms for the overseer. The staff of the Institute
des the chief, 4 assistants, 1 chemist and 1 clerk, under the direct
e of the Ministry of Agriculture.

Some idea of the recent work of the Institute can be obtained from the
ing figures showing the material under investigation:

. . . . .	3708 plots	883 plots of pedigree wheat from workers in different parts of the country.
		1758 plots of F_3 generations.
		128 » » F_2 »
		256 » » F_1 »
		683 » for the trial of foreign varieties

Rye	1997 plots	selected from different varieties.
Barley	179 »	of selected strains.
Oats	620 »	
Maize	75 »	
Potatoes	410 »	of hybrids.
Lucerne and clover .	2263 »	of selected strains.

y means of gratuitous advice to practical agriculturists on the carry-
t of selection methods and local selection experiments, the Institute
anised so as to meet the requirements of the different districts by
cing varieties adapted to the various climatic and soil conditions.
est types thus obtained by practical workers are tested in the experi-
l fields of the Institute, subjected to rigorous investigation and
used for hybridisation work. This intimate collaboration with the
al agriculturists in the different districts promotes the success of
rk of the Institute and the adoption of its methods throughout the
y. Questions affecting the theory of selection and the improvement
nts (clover and lucerne) not undertaken by the practical agricul-
are under investigation in the experimental fields of the Insti-
nd any results obtained will be immediately adapted to the climatic
ions of the different districts.

The work of the Institute may be summarised as follows: 1) extend its sphere of activity thoroughout the entire country and securing the ad tion of its methods by the practical agriculturists; 2) directing local w among the agriculturists; 3) researches on the theory of selecti 4) making known the principles of selection by means of publications lectures; 5) selection of plants not undertaken by practical agricultur

Tobacco, flax and hemp are not included in the programme of the stitute, a separate experimental station being devoted to each of th The selection work is chiefly concerned with the chief crop pla The accompanying list gives the distribution of the different crop percentages of the total cultivated area (excluding Croatia-Slavon which has varied during the last five years between 31 and 32 mill acres.

Wheat, autumn	27.49	to	30.45
» spring	0.88	»	1.07
Maize	20.42	»	21.71
Oats	9.15	»	9.56
Barley, spring	8.72	»	9.63
» autumn	0.48	»	0.58
Rye, autumn	8.61	»	9.20
» spring	0.17	»	0.24
Potatoes	4.97	»	5.28
Lucerne, clover	4.49	»	4.98
Mixture of vetches, moha (*Panicum germanicum*) and other forage plants	3.78	»	4.16
Sugar-beets	0.90	»	0.99
Mangels	1.62	»	1.73
Other plants (e. g. sorghum)	1.08	»	1.15
Maize (forage)	0.78	»	0.89
Meslin (wheat and rye)	0.48	»	0.62
Hemp	0.46	»	0.49
Flax	0.07	»	0.11
Tabacco	0.42	»	0.44
Vetches	0.37	»	0.41
Pulse (peas, lentils, beans)	0.25	»	0.28
Colza	0.14	»	0.24
Millet	0.18	»	0.25
Buckwheat	0.03	»	0.05

The Institute occupies itself, in the first place, with the differen reals, potatoes, sugar-beets, mangels, lucerne and clover, and only un takes the improvement of other crops when their development req it. Owing to its very recent organisation it is not able to show resul all the branches of its activity. Several years before the creation of Institute the present chief began operations in the selection of wheat, w have been continued now for eight years in various districts. As a re of this selection we have already obtained selected strains of wheat der from common Hungarian wheat by rational methods of selection; w have given increased yields of 7 ½ to 9 bushels per acre in the field t

ing the last three years. The experiments on the selection of other nts, though at present in the early stages, give promise of equally good lt, and we have reason to expect that the Institute will realise in the r future the task which it has undertaken, *i. e.* to increase the product- ness of the country by the creation of more productive varieties suitable the climate and soil conditions. In direct relation to the practical blems, scientific reseaches concerning the reorganisation and develop- nt of the methods of selection are in course of progress, and good results expected from them.

- **Studies on Variation and Selection.** — HAGEDOORN, A. L. and Mrs. A. C. in *Zeitschrift für Induktive Abstammungs- und Vererbungslehre*, Vol. II, No. 3, pp. 145-183 + 4 figs. Berlin, January 1914.

This is a survey of the progress made in the Mendelian interpretation variation and selection. The difficulties of the present terminology pointed out and a plea is made for more precise definition and use of ns. The criticisms of the zoologists are analysed and answered by re- s from the writers' own experiments.

- **The Preservation of Pollen.** — ROEMER, TH. in *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 1, pp. 83-86. Berlin, January 1913.

The writer has established by experiments that the pollen used for art- al fertilization preserves its power of germination best when kept at w temperature and in the driest air.

- **Variation in the Hereditary Value of Characters in Individual Flowers of *Pisum sativum*.** — ZEDERBAUER E. in *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 1, pp. 1-26. Berlin, January 1914.

The writer had for some years observed that in the splitting up of the l-characters in the F_2 generation of crosses of certain peas, there was fference according to the position on the plants, as for instance that the st pods gave yellow seeds, while green ones began to appear in the dle pods and were more numerous in the highest ones. This led him to e a careful examination of the results obtained by crossing the flowers rning in different positions on the plants.

The parents used were Wunder von Amerika (green wrinkled seeds) and lös de Grâce (yellow smooth seeds); these varieties agree in being 8 2 inches high and in bearing the first flower in the axil of the seventh ighth leaf. For these varieties the 1st and 2nd flowers are reckoned arly, the 3rd to 4th or 5th as middle and the remaineder as late.

Crosses between flowers of the same period (*e. g.* early × early) are called *ironous*, and those between flowers of different periods (*e. g.* early × late) *ochronous*.

Table I gives a summary of the results (F_1 generation seeds) from crossing of a large number of flowers on ten plants, in which the female nt (M) was Wunder von Amerika and the male parent (P) Auslös de e: the yellow and smooth characters of the latter are dominant. On y plant one or more flowers were selfed as a test of purity and all gave ixed wrinkled green seeds.

TABLE I.

M No. of flower	P No. of flower	yellow	yellow, tinged green	yellowish green	green	smooth	slightly wrinkled	wrink
			a) *isochronous crosses*.					
1	1	—	—	8	16	8	—	
2	2	—	1	15	1	16	—	
3	3	—	—	12	1	12	—	
4	4	—	3	12	1	11	4	
5	5	—	1	—	1	1	—	
Total per cent.		—	7	65	28	67	5	
			b) *heterochronous crosses*.					
			1) middle M by early P.					
3	1	—	4	1	—	5	—	
2	1	—	1	1	2	2	—	
Total per cent.		—	56	22	22	78	—	
			2) late M by early P.					
5	1	—	11	4	—	14	1	
6	1	—	7	1	—	5	3	
6	2	2	1	1	—	2	2	
7	1	1	2	—	—	—	3	
Total per cent.		10	70	20	—	70	30	
			3) early P by M of various ages (in per cent.).					
1	1	—	—	33	67	33	—	
2	1	—	—	80	20	70	10	
3	1	—	80	20	—	100	—	
4	1	—	25	25	50	50	—	
5	1	—	73	27	—	93	7	
6	1	—	86	14	—	63	37	
7	1	33	67	—	—	—	100	

A second series was carried out with the reciprocal cross. Here isochronous crosses gave 16 per cent. yellow, 52 per cent. yellow tinged green and 32 per cent. yellowish green (no green), and 100 per cent. smo heterochronous crosses gave for M1 × P6, 19 per cent. yellow and 8 cent. yellow tinged with green, and for M6 × P1, 100 per cent. yello green.

In discussing these results, the writer suggests using the term "vale for the power of transmission of a character: thus dominant becomes valent and recessive sub-valent, while equi-valent is used for cases in w

F_1, characters are intermediate; these terms refer to valency in space nmliche Wertigkeit). The valency is modified by the period of opening e flower: thus the early flowers have high valency the middle ones lerate valency, and the late ones low valency, these terms referring to ncy in time (Zeitliche Wertigkeit). The valency of the character her varies with the sex to which it is attached, being higher in the ale.

A hypothetical scheme may be drawn up for the valency (Wertigkeit) of the differ- haracters in the flowers of the different periods (when yellow is associated with the le parent):

Valency of yellow, (M) in . .	early flowers (I)	24
	middle » (II)	18
	late » (III)	12
Valency of green (P) in . . .	early flowers (I)	20
	middle » (II)	15
	late » (III)	10

Thus M (II) 18 × P (I) 20 will give preponderance of P, M (II) 18 × P (II) 15 pre- derance of M, and M (II) 18 × P (III) 10 preponderance of M (probably unmixed M). In the case of smooth and wrinkled, the valency of the former character appears to igher relatively to the latter (*e. g.* 35 : 20) than in the colour pair (24 : 20), as it is not M (II) × P (I) that mixing occurs (where smooth is associated with the female parent).

On Differential Mortality with respect to Seed Weight occurring in Field ultures of *Pisum sativum*. — HARRIS, J. A. in *The American Naturalist*, ol. XLVIII, No. 566, pp. 83-86. New York, February 1914.

t has previously been shown (1) that the mortality of seeds of *Phaseolus ris* before germination is not random but differential or selective.

In these experiments with *Pisum sativum*, about 1000 seeds from each n commercial early (dwarf) varieties were weighed, individually la- l and planted in short rows in the experimental field. The weight ibutions were based on differences of 0.025 gram, and the mean weights oefficients of variability were calculated from the variates thus obtained. n the plants had grown about 3 in. high, counts were made of the seeds h had failed to germinate.

In seven varieties it was found that the mean weight of the seeds which germinated was greater than the mean of the ungerminated seeds. In emaining three varieties the mean weight was greater in the ungermin- seeds, the differences between the means being 2.2, 3.9 and 5.5 s their probable errors respectively. In at least one case, therefore, e is a tendency for the lighter seeds to show a viability greater than of the heavier seeds.

Comparison of the standard deviations and coefficients of variability e ten varieties shows that the variation of seed weight is less in the seeds reater viability in 7 cases, but these are not the same varieties in which mean weight was greater.

These results are therefore in agreement with those obtained in the case *haseolus*.

(1) See No. 110, *B.* Feb. 1914. (*Ed.*).

328 – A Genetic Analysis of the Changes produced by Selection in Experim with Tobacco. — EAST, E. M. and HAYES, H. K. in *The American Natura* Vol XLVIII No. 565, pp. 5-48 + 9 figs. New York, January 1914.

These experiments were designed with a view to testing the the of Johannsen regarding the finality of selection of pure lines, and to sh that the changes which follow the continuous selection of extremes un certain conditions are to be interpreted entirely by the segregation recombination of hypothetical gametic factors which are constant in th reactions under identical conditions.

Nicotiana tabacum was chosen as being easily grown, naturally s fertilised, and prolific in seed production, that is to say ideal for the purp Number of leaves was the character studied, since it is unaffected by e ronment (except during the critical period of development in the embr The parental cross was made between the Havana variety having a ra of 16 to 25 leaves and an average of 20, and the Sumatra variety wi range of 21 to 32 leaves and an average of 26. The results of this cross set out below:

	Sumatra × Havana
No. of leaves	21 – 32 | 16 – 25
Coeff. of variability	6.64 ± 0.27% | 6.98 ± 0.27 %
	↓ F_1
No. of leaves (average)	23.3 ± 0.14 %
Coeff. de variability	6.24 ± 0.41 %
	↓ F_2
No. of leaves	18 – 31
Coeff. de variability	10.29 ± 0.23 %

Thus the F_1 generation is intermediate between the parents and practically the same coefficient of variability. The F_2 generation extremely variable and included both the parental types. Some combi the leaf size and habit of growth of the Havana parent with the leaf num of the Sumatra parent, and therefore resembled the type obtained by Sha in 1906 in the F_2 generation of the reciprocal cross between these varieties. This hybrid, known as Halladay, had 26 small round-poin leaves with short internodes, and was supposed to be a mutation. In 1 100 seed plants of this hybrid were selfed, and produced the material in these selection experiments. Accurate observations of the prog of these F_3 and F_4 plants showed that their homozygosity was only parent. The general type of the plants appeared to be constant, but frequency distribution for number of leaves was not the same in the and F_6 populations.

Selection was made of the extremes in these generations with following results:

Generation	No. of leaves of parent	Range of no. of leaves	Mean	Mode
. . . . .	—	—	—	25
. . . . .	—	—	—	23
. . . . .	23	20 to 27	22.4 ± 0.11	22
. . . . .	20	17 to 28	21.9 ± 0.08	21
	27	20 to 32	24.9 ± 0.11	25
. . . . .	20	18 to 26	21.3 ± 0.05	21
	30	22 to 33	26.6 ± 0.07	26
. . . . .	20	14 to 25	18.4 ± 0.07	18

The extremes selected for the parent plants were not members of the extreme classes, yet selection of the minus variants reduced the mode 23 to 18 and selection of the plus variants raised the mode from 23 5.

n a duplicate set of experiments at New Haven, Connecticut, selection e minus variants reduced the mode in three generations from 21 and the plus selections increased the mode to 28. In the F_3 gen- n there was a difference of 9 between the means of the two strains. he results of selection in other strains did not give such regular es in the modes of each generation, and, in some of them selection ced no change at all. This is what would be expected in strains ferent degrees of heterozygosity.

n one particular strain, selection of the minus variants produced prac- no change in the mode in three sets of experiments, while selection of us variants raised the mean to 30.7, 29.6, 30.8 in the three correspond- us strains. In these experiments at Bloomfield, the F_8 generation the plus extreme showed a remarkable range of variation, from 36.

n another strain, selection of both extremes resulted in a slight in- in the mean during three generations, and, in the F_7 generation of us strain having a mean of 25.7 ± 0.09, a 12-leaved plant appeared. ividual with 12 leave shad never been observed before, though thous- of plants have been examined. The distribution of plants in this tion was as follows:

aves	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
y	—	—	1	—	—	—	—	—	—	—	1	1	4	24	36	42	44	41	21	13	7	—	—	—

his 12-leaved plant was selfed and gave rise to a population giving llowing analysis.

Generation	No. of leaves of parent	Range of no. of leaves	Mean
F_6	28 (12)	20 to 30	25·7 ± 0·09
F_7	12	8 to 30	19·8 ± 0·28
F_8	10	11 to 27	17·9 ± 0·08

Evidently a mutation occurred in the F_6 generation and this mut did not breed true as in the case of those of De Vries.

Conclusions.

The results show that the Halladay hybrid originated in the segr ation and recombination of the characters of the parents (Havana and matra) and not as a mutation. The fact that strains were obtained fr this hybrid with a greater mean number of leaves than even the Sumat parent shows that the difference between the parent varieties in leaf num is greater factorially than somatically. The original hybrid, which supposed to breed true, gave rise to plus and minus strains showing progr ive changes on selection, and also to strains which showed no change appeared to breed true to type ; but it is not possible to say that any the strains are so fixed that no progress could be made by selection. Sho a sufficient number of hybrids be obtained, so as to include a perfe homozygous strain, such type would be found constant for all practical pu poses. It may be, however, that long-continued experiment with e mous numbers will show some slight shifting of the mean, and that may be due to the slow progress of evolution. Such changes could hav be determined experimentally beyond reasonable doubt.

Mutations may occur due to constitutional changes in a single g cell, and they therefore appear as F_1 generations giving rise to several strains requiring selection. Since mutations are not of very frequent oc rence in any particular strain, it is only the comparatively large jumps are economically important, and these are easily detected without refi methods of procedure. It therefore seems unwise for the practical bree to expend time and money in obtaining results that are so slow and trifling that they cannot be detected in carefully planned and accura executed genetic investigations. The only financially profitable proce is the isolation of homozygous strains from mixtures of either a mechan or physiological nature.

Advantage should also be taken of the fluctuating variability wh takes place during the critical period of seed formation. Seed from well-d eloped mother plants will produce plants with a slightly higher leaf num than seed from plants grown under poor conditions .The disturbance to transplanting, though not affecting the number of leaves produ affects their development and maturation, and should therefore not be layed too long.

1 - **Cereals Indigenous to Mongolia.** — PALIBINE, J. W. in *Annalen der Samen-prüfungsanstalt am Kaiserlichen Botanischen Garten Peters des Grossen*, Vol. II, No. 1, pp. 1-12 + figs. (summary in French, pp. 13-16). St. Petersbourg, 1914.

The travels of Mlle. K. W. Jourganoff in N. E. Mongolia during the tumn of 1911 have resulted in the re-discovery of two psammophytic eals known locally as " khar-soul " and " tsagan-soul " respectively and ch appreciated by the Mongols as a source of food.

1. Khar-soul — *Arundo villosa* Trin. (*Calamagrostis villosa* herb. de nius) ; *Psamma villosa* Maxim. This was discovered by Prof. Bunge 831 and has not yet been entered in the " Index Kewensis " . Specimens st in the herbarium of the Imperial Botanic Garden of Peter the Great St. Petersburg, and in the herbarium of G. Potanine. The plant has a izontal sympodial rhizome producing a series of upright shoots, and is pted for binding sand dunes. The grains are long and oval in shape h a black pigmented pericarp ; the starch grains are compound like se of oats. Each ear is harvested separately by means of a knife, and Mongols, who travel on camels, may collect 150 to 180 lbs. of grain h during the season.

2. Tsagan-soul—*Elymus giganteus*, Vahl.; *E. arenarius* L., var. *giganteus* mallh. This plant is very similar to *E. arenarius*, but larger in all dimensions. It occurs in the steppes and sandy places in the south of ssia, near the Caspian sea, in Orenburg and north of the Caucasus, as l as in Turkestan, on the Tian-Schan and in Siberia. The grain is te in colour and is much preferred to khar-soul by the Mongols. e grain of *E. arenarius* L. used to be used for flour in Western Europe in es of scarcity, and is still regularly collected in Iceland, but this grain uch smaller than that of *E. giganteus* Vahl.

These cereals, being adapted to climates with very low rainfall and for ding waste sand dunes, should be of considerable interest for experiment many parts of the world.

2 - **Contributions to the Question of the Frost-Resistance of Cereals.** — GASSNER, G. and GRIMME, C. IN *Berichte der Deutschen Botanischen Gesellschaft*, Vol. XXXI, Part 8, pp. 507-516. Berlin, 1913.

To extend the work of other investigators, experiments were carried with grains from very even samples of Petkused winter and spring rye, minated at 5-6° and at 28° C.; the first leaves were analysed for sugar. ble I gives the results in percentage of dry matter.

Thus the seedlings which had germinated at the lower temperature l were therefore more frost-resistant) were readily distinguishable from se which had germinated at the higher temperature by their higher ar-content ; at the same time seedlings of the hardy Petkuser winter rye w a higher sugar-content than those of Petkuser spring rye grown under same conditions.

Experiments with barley gave corresponding data.

These results indicate that with cereals also the sugar-content has an uence on resistance to cold.

TABLE I.

Series	Germination temperature 5-6°			Germination temperature 28°		
	Total sugar	Reducing sugar	Non-reducing sugar	Total sugar	Reducing sugar	Non-reducing sugar
			Petkuser winter rye			
I	42.19	34.93	7.26	40.92	32.56	8.36
II	43.14	35.86	7.28	39.79	31.14	8.65
III	41.92	34.84	7.08	39.13	31.08	8.05
IV	42.31	35.85	6.46	40.73	33.94	6.79
V	40.97	32.31	8.66	39.52	34.11	5.41
			Petkuser spring rye.			
I	36.58	29.41	7.17	31.57	27.13	4.44
II	37.08	30.57	6.51	33.26	26.58	4.68
III	35.39	30.41	4.98	32.59	26.81	5.78
IV	37.65	31.02	6.63	34.56	30.38	4.18
V	35.85	30.21	5.64	32.94	28.16	4.78

Further experiments, which it was not possible to complete, show th the slighter differences in hardiness among individual varieties of wint grain correspond to slight differences in the sugar-content.

331 – **Environmental Influences on the Physical and Chemical Characteristi of Wheat.** — LE CLERC, J. A. and YODER, P. A. in *The Journal of Agricultu Research*, Vol. I, No. 4, pp. 275-291. Washington, D. C., January 1914.

This paper is a continuation of previous work showing that the comp sition and physical characteristics of wheat are not to any great exte hereditary.

To distinguish between the effects of the soil and those of climat samples of soil 5 feet square and 3 feet deep were interchanged amo three localities, in Maryland, Kansas and California respectively, possessi widely different climatic conditions.

Four plots were arranged at each station as follows :

1 plot of undisturbed local soil as control.
1 plot of local soil . . . . . } taken up in layers of 3 inches
2 plots of imported soil, one from each station. } to a depth of three feet and replaced in original order.

During 1908 and 1909 Crimean wheat from Kansas was grown on 12 plots, but as it was found to be unsuitable to the conditions prevaili in Maryland and California, it was replaced by Turkey wheat in 191 1911 and 1912.

TABLE I.

Determination	Averages of the three soils		
	California	Kansas	Maryland
Physical properties:			
. . . . . per cent.	8.98	9.53	9.53
t per 1000 grains . . . . . grams.	30.2	19.1	25.6
t per bushel . . . . . lbs.	62.8	57.2	60.1
grains . . . . . per cent.	86	99	35
mical analysis on water-free basis:			
en . . . . . per cent.	2.42	3.30	2.18
) (N × 5.7) . . . . . »	13.11	18.83	12.43
l-soluble nitrogen . . . . . »	0.92	1.27	0.90
l in protein . . . . . »	41	42	40
. . . . . »	1.97	2.	1.94
. . . . . »	2.34	2.89	2.63
ans . . . . . »	8.45	8.76	8.56
. . . . . »	3.61	3.32	3.03
. . . . . »	1.60	2.30	2.22
oric acid . . . . . »	0.90	1.02	1.18
. . . . . »	0.57	0.68	0.67
oric acid in ash . . . . . »	47	45	53
in ash . . . . . »	29	30	30

he following determinations were made according to the revised me- of the Bureau of Chemistry:

ater; weight of 1000 grains; weight of a bushel; flinty grains; nitrogen; alcohol- nitrogen; fat; fibre; pentosans; sugars; ash; phosphoric acid; and potash.

he results obtained are summarised in Tables I and II. In Table I are arranged as averages of the three soils for each district and the difference due to climatic influence. In Table II they are ar- d as averages of the three districts and show the effect of soil tions.

he results of the undisturbed control plots showed that the disturbance soil had not effected the constitution of the plants.

comparison of the results in Tables I and II shows that only the tic conditions have any considerable influence upon the properties omposition of the crop.

onsidering weight of grain, the figures for weight per 1000 grains show lerable difference in Table II, showing the effect of soil conditions; but differences are much smaller than those in Table I, showing that the

TABLE II.

Determination	Averages of the three districts		
	California Soil	Kansas Soil	Maryla Soil
Physical properties:			
Water . . . . . per cent.	9.35	9.46	9.
Weight per 1000 grains . . . . . grams.	26.5	27.9	22.
Weight per bushel . . . . . lbs.	60.9	60.4	—
Flinty grains. . . . . per cent.	71	69	85
Chemical analysis on water-free basis:			
Nitrogen . . . . . per cent.	2.48	2.52	2.
Protein (N × 5.7) . . . . . »	13.88	13.94	13
Alchol-soluble nitrogen . . . . . »	1.	0.94	1.
Gliadin in protein. . . . . »	42	41	40
Fat . . . . . »	1.93	1.98	1.
Fiber . . . . . »	2.55	2.59	2
Pentosans . . . . . »	8.41	8.48	8
Sugars . . . . . »	3.33	3.48	3
Ash . . . . . »	2.13	2.08	2
Phosphoric acid. . . . . »	1.04	1.03	1
Potash. . . . . »	0.64	0.61	0
Phosphoric acid in ash . . . . . »	48	48	48
Potash in ash. . . . . «	30	29	29

climatic effect is much greater than that due to the soil. Similarly, the ures for the flintiness of grain show more variation due to climate tha soil.

With regard to the chemical constituents, the figures for the dete nations of nitrogen, protein, ash and phosphoric acid show a much gre variation due to changes of climate than to changes in the soil. L or no regular variation occurs in the proportions of gliadin, potash in ash, fat, fibre, pentosans and sugars.

The writer suggests the following possibilities as to the manne which the climatic factors exert a determining influence on the compos of the wheat crop:

1) Differences in humidity may cause a difference in the trans tion of the plant, which in turn may react on the composition of the crop.

2) Variations in the amount and distribution of sunlight may fluence diversely the photosynthesis of the plants.

3) Differences in temperatures and in the succession of hot and periods may cause varying vegetative activities in the plants.

4) The climatic differences, such as humidity, rainfall, temperature sunlight, may bring about changes in the physical chemical, or biolo- characteristics of the soil, which in turn may react on the crop.
Thus it may not be impossible for soil which has been transferred from locality to another, to become so changed by climatic environment the character of the wheat grown thereon would be approximately the as that grown in soil belonging to the locality.
The great difference between the protein of the Kansas and the Mary- crops cannot be attributed to the greater nitrification in the Maryland when transferred to Kansas, since applications of nitrate as fertiliser uce only a slight increase in the protein content of the crop.
The writers consider that these results confirm the conclusion of pre- work (1) that environment (climate in particular) rather than here- is the major factor in determining the physical and chemical charac- ics of the wheat crop.

Some Characteristics of the Endosperm of Chevallier and Goldthorpe Barleys. — VINE, H. C. A. in *The Journal of the Institute of Brewing*, Vol. XX, No. 1, p. 23-33 + 2 figs. London, January 1914.

Microscopic examination was made of several verified specimens o. allier and Goldthorpe barleys with a view to determining any specific ences in the characters of their starch granules. The author ob- s that the starch grains from barley, unlike those of the potato which asily be disintegrated, remain intact after long grinding with the hardest , showing that they possess elasticity and resiliency.
In the Goldthorpe varieties the round form of granule predominates, in the Chevallier varieties the oval form is the general feature. This ence in shape of the grains is only well marked in pedigree strains, cannot be used to distinguish commercial varieties with reliable re- . The ratio of large and small granules is a much more definite ion, and may prove to be useful in indicating the extent to which any sample has varied from the true stock. Counts of the numbers of h granules of different sizes gave the following results :

		Percentages of granules:					
Size of granules in inches		1/1000	3/5000	2/5000	1/5000	1/10 000	1/20 000
	No. of granules counted						
llier	228	0.00	3.70	7.42	3.20	19.20	65.8
orpe	626	0.47	2.07	2.55	2.07	17.00	76.0
well	445	0.00	2.19	5.06	2.36	14.70	77.0

1 See LE CLERC, J. A. and LEAVITT, SHERMAN. — *U. S. Dept. Agr., Bur., Chem.*, 123, 1910.

Thus Goldthorpe varieties contain a greater proportion of gran under $\frac{1}{10\,000}$ of an inch.

The effect of climate and soil on the proportions of the grains of dif ent sizes still requires to be worked out.

The cell walls of the endosperm present no features which can b any way regarded as characteristic of Chevallier and Goldthorpe resp ively, although on the whole the laminae of the former are somew thinner and more delicate than those of the latter.

333 – **A Drought-resisting Adaptation in Seedlings of Hopi Maize.** – Collins, in *The Journal of Agricultural Research*, Vol. I, No. 4, pp. 293-301 + 4 plates. W ington, D. C., January 1914.

The proper depth at which to plant maize seeds has been the sub of many experiments, but with little consistency in the results. It not hitherto appear to have been realised that it might be dependent up biological factor, definite for each variety or even each individual.

A study of the varieties of maize grown by the Indians in New Me and Arizona has brought to light an important adaptative chara connected with germination and growth. Studies of seedlings of H maize sown at different depths show that the mesocotyl, *i. e.* the por of the stem between the cotyledonary sheath and the seed, may freque develop to a length of 36 cm., and that it may give rise to roots at point on its surface. Observations of many varieties of maize have sh that it is the elongation of the mesocotyl that enables the shoot to re the surface, and the maximum extent of elongation is fixed and reasona constant for each variety.

In the varieties of maize commonly grown the writer has been un to force the mesocotyl to a length greater than 10 cm., and many seedli have failed to come up where there was less than 2 cm. between the to the cotyledonary sheath and the surface of the ground.

In the root system of the Indian varieties there are no second seminal roots, the radicle being the only root arising from the seed. Th single seminal roots have been traced to a depth of 35 cm., and even furt and are obviously an adaptation to extreme conditions.

The Indians plant these seeds in hills about 20 feet apart, with from to 20 plants in a hill. There is no fixed depth for planting, the custom b to plant deep enough to place the seed in moist soil. The plants grow a height of from 60 to 90 cm., and produce ears near the surface of ground.

Under irrigation conditions these varieties compare favourably with more improved eastern varieties in these dry regions ; 36 plants harves gave 94 ears weighing 37.6 lbs.

The peculiar adaptations of these varieties — a greatly elongated me cotyl, permitting deep planting and the rapid development of a la single radicle — give them considerable economic importance for semiarid regions.

A Cultural Experiment with American and African Dent Corn. — WACKER in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 3, pp. 73-75. Stuttgart, February 1914.

The comparative cultural experiments carried out in the summer of with Virginian and Natal corn showed that there is little material rence between the two kinds in yield of fodder.

This result agrees with those obtained in the writer's earlier experints, but is at variance with the results obtained by Stebler and Volkart 907-1909 in Switzerland.

The Physiology of the Germination of Rice. — AKEMINE, M. in *Fühlings andwirtschaftliche Zeitung*, Year 63, Part 3, pp. 78-93. Stuttgart, February 1914.

The writer, who, during a series of years, has studied the conditions of ination of rice, summarises the results hitherto obtained as follows:

1) — The maximum, optimum and minimum temperatures for the ination of rice are 40° C., 30 to 35° C. and 10 to 13° C. respectively. n the practical point of view it is important to know that the develop- t of strong seedlings is favoured by warm irrigation water.

2) — Light exerts no influence on the germination of rice.

3) — The same holds true for light of varying refraction.

4) — Rice germinates equally well both in water and in air, when grains are husked or unhusked, and when the grains are treated with r which contains oxygen or which has been deprived of it by boiling.

5) — The plumule appears sooner if the grain is placed in favourable ture conditions than in water.

6) — The radicles and crown roots develop considerably sooner in ir than in water.

7) — The stem grows much more rapidly in water than in the air. opposite is the case with the radicles and crown roots.

8) — The frequent renewal of the water in the experiment had rrible effect upon the development of the stem or roots.

9) — The same holds true for differences in the depth of water, ided they keep within the limits of 3 to 20 cm. (1.2 to 8 inches).

10) — The suitable degree of moisture for the germination of rice is 95 per cent. by weight of the seed-bed's capacity for water.

11) — Rice grains are saturated by an amount of water equal to t 25 to 30 per cent. of their air-dry weight.

12) — Rice grains cannot be made to germinate until they have ab- d about 25 per cent. of their air-dry weight of water.

13) — The loss of weight of the unhulled grains during steeping nts to only 1.5 per cent. of their weight, even after 20 days, e temperature is 10° to 15° C. (50° to 59° F.).

The Prevention of Degeneration in Potatoes. — Communication from the Saatzuchtstelle der Deutscher Landwirtschafts-Gesellschaft" in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, No. 7, p. 98. Berlin, February 14, 1914.

The degeneration of a strain of potatoes originates as a result of any of diseases which prevent their complete development. Its progress from

one generation to another can be prevented by means of the selecti tubers from well-developed plants marked in the fields during the sum only such roots should be selected, as come up to the expectation of the vious selection. The tubers of each plant should be grown separ the following year, and the experiment repeated for several years the desired result has been obtained.

337 – **The Effect of the Weight of Seed Potatoes Upon the Succeeding** — LYVE, A. v. (Author's abstract) in *Zeitschrift für Pflanzenzüchtung*, V Part 1, p. 72. Berlin, 1913.

In 1912, the weight of all the tubers of 24 potato plants was d mined; those which weighed more than 15 grams (in some cases all th bers of the plant) were planted. The estimation of the weight of the when gathered showed that the weight of the seed potatoes exerci very great influence upon the total crop of the daughter plants. influence was less noticeable and more inconstant in the case of the h tubers, but here also the heavier seed-potatoes produced the larger cro

338 – **The "Amylometer": a New Apparatus for Estimating the Starch tent of Potatoes.** — MENZEL, V. and STEMPEL, G. in *Zeitschrift für das La schaftliche Versuchswesen in Österreich*, Year XVI, Part 9, pp. 893-898. Vienna

The writer describes a new apparatus by the use of which the s content of quite a small number of potatoes, and even of a single t can be determined. The apparatus is very useful for breeders who ha deal with a large number of single tubers.

339 – **A Society for Promoting the Cultivation and Economic Utilizati Potatoes (B. V. K.)** *Deutsche Landwirtschaftliche Presse*, Year XLI, No. 3, No. 17; p. 210; *Zeitschrift für Spiritusindustrie*, Year XXXVII, No 10, p. 132; Jan. 10, Feb. 23 and March 5, 1914.

During the great agricultural week held this year at Berlin, in Febr a new society was founded for the promotion of the cultivation of pot and the encouragement of their use for various economic purposes.

The society has its seat in Berlin and is based up on the organiz of the "Verwertungsverband Deutscher Spiritusfabrickanten", it has recognized by the three most important societies for the promotion o tato cultivation in Germany, *viz.* the "Verein der Spiritusfabrikant Deutschland", the "Verein der Stärke-Interessenten in Deutschl and the "Verein Deutscher Kartoffeltrockner".

The Society does not wish to promote potato growing at the expe other crops, but desires to raise the yield per surface unit, which it to effect by instituting cultural experiments with different varieties, a experiments in growing and manuring the crops, etc. It is also anxiou order to develop the possibilities of utilizing the increased supply (a n sary condition of the attainment of its first aim), to improve the ke qualities of the tubers by cheaper and better methods of preserving t and to enlarge the market for fresh and dried products. The Associ is endeavouring to centralise all scattered efforts in these directions. members undertake to preserve a certain portion of their potatoes

ant depending on the crop and the condition of the market at the ; the potatoes are to be ensilaged or dried. It is hoped that by this ns a balance will be kept between excessively large and small potato s, and that the trade will be more regular and the prices steadier.

. Grassland in Britain: Types and their Formation. — SMITH, W. G. and CRAMPTON, C. B. in *The Journal of Agricultural Science*, Vol. VI, No. 1, pp. 1-17, Fig. 1-4. Cambridge, January, 1914.

In considering grassland from the ecological point of view (soil, cli- e and topography), the causes leading to its formation may be divided two groups: 1) natural, and 2) artificial.

Natural grasslands can be separated into two groups, the stable and atory types; the latter depend on periodic flooding, flushing and re- al of surface fertility; these types occur on alluvial and rain-washed or ig-flushed surfaces, along river and coastal belts, and on mountain es. The stable types, on the other hand, depend on the nature of the erlying rocks and their physiography, which limit the growth of tree tation and prevent infertility due to leaching and stagnancy. Such le grasslands are found in Britain on: 1) chalk downs, 2) exposed hill ridges of rocks containing an abundance of lime, such as limestone nding some calcareous or boulder clays, etc), and basic igneous rocks as the isolated hills of dolerite common in Mid Scotland.

Artificially induced grasslands originated as the result of a widespread and for pasturage and hay in districts where the natural grasslands are limited for economic requirements. They usually show marked va- ons, apparently unconnected with the nature of the habitat, and fre- ntly require constant attention to maintain their grazing value. Some- s, however, they acquire a certain amount of stability by a process of ution, following on the destruction of the original vegetation and a e of tillage. Examples occur in the old established pastures of the land counties of England.

Owing to the cold temperate climate with moist summers and open er, grassland is not altitudinally zonal to climate in Britain; but this ate favours leaching and surface exhaustion in well-drained places, lting in soil acidity and accumulation of peat, and these are the great ical enemies of grassland in this country. Thus one of the first signs isture deterioration in a wet district is the formation of a thick sod osses and plant remains, so dense that summer rains cannot penetrate e soil below; surface-rooting species (*Agrostis*, *Anthoxanthum*, *Lu-* etc.) then take possession, and deeper rooting species (*e. g.* white t) dwindle away.

The natural conditions which favour grassland in Britain are there- those which prevent:

1) leaching of the surface in well-drained positions, leading to compe- n with heath; 2) rapid accumulation of raw humus, and competi- with moorland species; 3) stagnancy and souring of the soil in low- positions, and competition with marsh; 4) the growth of forest.

The factors preventing leaching on an elevated or well-drained are : *a*) a finely divided thin residual soil resting on a soluble or su weathering rock basis which constantly supplies mineral nutriment, cially lime ; *b*) periodical flushing of sloping surfaces with waters co ing alkaline bases in solution, a natural process corresponding to the ficial top-dressing of basic slag and phosphates. Examples occur on ex alpine, coastal or moorland slopes.

The factors preventing the souring of the soil and rapid accumu of raw humus are : *a*) alternate flooding and rapid drainage, *b*) a suffi of alkaline bases in solution or in suspension where drainage is less eff

The factors which prevent the growth of forest are: *a*) great wind sure, *e. g.* coastal slopes, coastal plains and plateaux ; *b*) a shallow soi smooth, unfissured rock in exposed positions allowing no foothold for *c*) a water-table too high, or a roothold too unstable, on wind-swept a surfaces. The establishment of grassland attracts grazing animals are a most efficient means of suppressing tree seedlings.

Natural grasslands are therefore restricted to :

1) Stable surfaces with a smooth elevated topography and a finely-divided soil supplied with alkaline bases from underlying roc

2) Sloping smooth surfaces subject to periodical flushing with eralised waters.

3) Alluvial surfaces along rivers, periodically flooded and dr

4) All surfaces favourable for grass roots in places much freq by grazing animals.

The vegetation of unstable surfaces is rapidly changed in cha in places neglected by grazing animals, whereas it may persist and b more extensive if well stocked.

Types of grassland occurring in Britain.

1. *Turf-forming types.* — These are pastures of natural formatic are usually closely cropped and perennially green. Their vegetative g consists of aerial and subterranean leafy shoots which seldom f On stable formations such as chalk downs, ridges and maritime slopes grasses such as sheep's fescue (*Festuca ovina*) predominate, scattered, large-rooted procumbent or acauline rosette plant trailing small-leaved herbs ; mosses are scarce or absent ; worms, ants and other invertebrates are abundant. The migratory o pastures occurring on flushed slopes consist chiefly of grasses wit and short leaves, such as *Agrostis* forms, *Anthoxanthum*, *T* and *Cynosurus*, and others such as *Holcus lanatus* ; sedges of the *panicea* or C. *flava* type occur ; mosses like *Hylocomium squarros Hypnum molluscum* are abundant; the invertebrate fauna is less abu than on the down types ; slugs generally replace snail, dipterous are abundant, while ants are usually absent. The vegetation is often cous in tint and unwettable, and contains some rosette-leaved with tall flowering shoots.

II. *Meadow types.* — These occur on porous alluvial loams with water-table and subjected to flooding, and are characterised by taller

including grasses of tufted and creeping habit. The grasses of low-d types consist of broad-leaved fescues, *Poa trivialis, Dactylis, Phleum, pecurus*, etc.; maritime types have *Hordeum, Phleum, Lolium, Triticum*, " and alpine types have alpine forms of *Festuca, Aira, Phleum*, , etc.

III. *Tussock types.* — These occur in many parts of the world on salt-ppes, wind-blown steppes and under conditions of perennial cold or id. They are composed of coarse, hard or or wiry grasses which tend to umulate soil by means of stools or tussocks of dead shoots. These es appear to be limited to unstable habitats in Britain, such as waste ps of mines and quarries, and artificially degenerated moorlands *rdus*).

IV. *The Stooled Meadow types.* — These may be considered as exagge-d forms of the tussock type, assuming the stooled habit as an adapta-to gentle flooding and silting. The principal grasses are *Aira coespi-* and *Molinia coerulea*. Tall rushes and stooled species of Sedge (*e. g. ex paniculata*) are often present.

V. *Lair grasslands and the Camp-follower types.* — This heterogenous up of grasslands is independent of physiographic and soil conditions. y are of a migratory character and depend on the influence of grazing nals for their formation and persistence. Examples of this type are nd in the neighbourhood of shelters and enclosures for sheep and cattle, near rabbit warrens.

Economic Aspects.

From a consideration of the natural factors which lead to the forma-of grasslands, the following deductions may be made :

1. Where these factors are in operation, and stable in character, no arti-l interference is necessary to procure good sheep-grazing, and no e treatment than judicious stocking should be attempted until well-blished results based on experiment are obtained.

2. Interference with the development of natural migratory grasslands uld not be undertaken without a careful consideration in each case of physiography or " lie of the land ", the nature of the waters and their ended materials, and the effect of tampering with the drainage. (Thus, e the natural flushing of peaty moorland by water often leads to the earance of patches of grassland, the conduction of such waters on to grasslands of the stream alluvia will in most cases promptly lead to ked deterioration in the pasture. Again, the underdraining of sandy loams accelerates the leaching natural to them, and thus favours heath ss frequent surface manuring with lime or slag is carried on).

3. The grazing and manuring of sheep and cattle on moorlands can do l to establish grassland where migratory geological factors are in ation, but no amount of overstocking will be effective if leaching has ced fertility and induced acidity.

4. Stability may be acquired by a gradual process of natural selection ose forms of grasses and other plants which are most suited to the ment in vogue, including grazing. (These differences in the same

species of plants in different fields may account for the differences in t feeding value of pastures having the same botanical analysis).

5. In determining treatment for the improvement of grassland, it see more probable that careful experiment will lead to better conclusions th botanical analysis alone. An interpretation of results obtained by the ap cation of manures or other treatment in consideration of the physiograp origin and history of the locality, would appear to be the more log method.

341 – **Rye-Grass and Clover in India.** — BROWN, W. ROBERTSON in *The Agricul Journal of India*, Vol. IX, Part I, pp. 87-91 + 1 plate. Calcutta, January 1914.

The occurrence of the darnel grass (*Lolium temulentum*) in the wh fields of the N. W. Frontier Province and Punjab suggested the introd tion of Italian rye-grass (*Lolium italicum*) as a forage grass for the c season.

Experiments with this grass in combination with broad red clo (*T. pratense*), shaftal (*T. resupinatum*), berseem (*T. Alexandrinum*) and cerne, show that it gives a weight of green fodder equal to the clover-crops obtained from the average English rye-grass-clover meadows. S ings made in August and September on manured and irrigated land enal three cuttings to be made during the cold season, *viz.* November, Febru and May.

The local advantages of such a crop are: 1) the cheap rate at whic may be cut by means of a sickle or mower, and 2) a yield of succulent g when indigenous grasses are not available.

342 – **Cotton in Asiatic Russia.** — SCHANTZ, M. — *Beihefte zum Tropenpflanzer*, Vol. No. 1, 134 pp. Berlin, February 1914.

This important monograph on the cotton question in Asiatic Ru completes the series of studies on cotton published by the writer.

It begins with an account of the general conditions of agricultur Turkestan: the dry and distinctly continental climate characterised considerable variations of temperature (— 44° to + 55° C.), the necessity irrigation, the very fertile soil, chiefly consisting of loess of Eolian orig

Varieties. — The most important native varieties are those of Ta kend, Bokhara and Khiva. The latter is more renowned; it yields 26 per ce of thread with a staple of 20 mm. length. Bokhara cotton has a sta of from 22 to 23 mm. in length, but is coarser.

The native varieties are characterised by the fact that their capsu scarcely open or even remain completely closed at maturity.

The cultivation of American varieties, introduced in 1870, has develop considerably since 1884; they now occupy 90 per cent. of the cotton ar American cotton gives a yield of thread of 30 to 35 per cent. and ha length of staple of 29 to 30 mm. The best varieties are King and Triun Turkestan cottons of American origin realise the price paid for Orlea Texas " good middling " quality of 28-29 mm. length.

Commercial qualities. — There are three principal qualities, *viz.* 1) c sisting of white fibres, 2) yellow fibres or slightly damaged by the c 3) grey fibres, of a deep yellow colour or strongly damaged by cold.

The cotton zone extends from 37° to 45° N., so that itssouthern nit is the northern limit of the American " Cotton belt ".

The cultivation is almost entirely in the hands of natives, whose farms erage from 2 to 5 acres and produce 90 per cent. of the total cotton crop.

Cultivation. — The virgin lands are too saline for the direct cultivation the crop. The preparation of the land consists in the removal of the salt irrigation and the cultivation of lucerne for several years. No regular ation is followed; cotton is grown continuously until the yield dimi-shes, when maize or leguminous crops are grown for several years.

The cultural operations are as follows :

1) Autumn tillage (6 to 8 inches), preceded by irrigation if the land too hard.

2) Spring cultivation to a depth of 14 inches.

3) Application of fertilisers, chiefly canal mud.

4) Preparation of the beds 28 to 32 inches broad and 10 to 18 inches ph. When water is plentiful the furrows between the beds are constructed a sinuous course so as to decrease the flow of water and obtain a better king of the soil.

5) Irrigation, if the soil is too dry for sowing, which is seldom the case.

6) The seeds are dibbled in holes 20 to 28 inches apart. The seeds uld be two years old in order to ensure regular germination, and obtained m the first picking. From 20 to 30 seeds are sown in each hole owing to their germinating power (60 %) and to facilitate the penetration of the face crust of the soil by the combined efforts of several shoots.

7) Irrigation, singling, weeding. The determination of the correct ntity of water is a very important and delicate problem. In Turkestan much water is generally given; 3 or 4 irrigations in place of the 10 to 12 sufficient.

8) Topping of the plants as soon as the flowering reaches a maximum e first half of July).

9) Picking from the middle of August until October, November and n December, should the weather be suitable.

The Upland cotton is picked as in America. In the case of the native ieties, the entire capsule is picked and the cotton separated after ing. The months of September and October in Turkestan are warm and , thus favouring the picking. The stems of the plants are used as fuel.

Pests. — The crop is subject to few insect and fungoid pests in Turke-n. Some regions, such as the Hungry Steppes, have been invaded by ng locusts, but the development of these is checked by irrigation.

Area under cotton and yield. — In 1913 there were 1 127 000 acres otton in the four " crown countries " of Turkestan, distributed in the owing manner :

Ferghana	729 000
Syr Daria	205 000
Samarkand	79 000
Transcaspia	114 000

The total yield of cotton, including Bokhara and Khiva, increased fr 127 000 tons in 1908 to 182 000 tons in 1912-13 distributed as follows:

	Thousands of tons
Ferghana	113
Syr Daria	13
Samarkand	10
Transcaspia	15
Bokhara	21
Khiva	10

The average yield per acre is:

Upland	210 to 235 lbs
Native varieties	170 lbs.

Of the various cotton regions of Turkestan studied by the writer, *ghana*, which produces two-thirds of the cotton in Asiatic Russia, deser special mention. Owing to its situation in a valley sheltered from winds, it has a relatively temperate climate. The cultivation is extend rapidly:

1888	91 000 acres
1900	502 000 »
1910	635 000 »
1913	729 000 »

American varieties are almost exclusively cultivated. The cot is of a beautiful white colour, with silky resistant fibres of 29 to 30 m staple. The first quality, comprising 60 to 70 per cent. of the harvest classed between " good middling " and " fully middling ".

Rotations:

1. Cotton	8 to 10 years
Sorghum or maize	2 »
2. Cotton	8 to 10 »
Lucerne	5 to 7 »
Sorghum or maize	1 »

Yield. — In 1913 the yield per acre in the district of Andidjan in g estates was about 450 to 550 lbs. for Triumph and 350 to 450 lbs. for K

Cost of maintenance of one " dessiatine " (2 3/4 acres).

	£	s	d
Manures	2	2	0
Distribution		2	6
3 cultivations	1	18	0
Preparation of beds	1	5	6
Seed		8	0
Sowing		10	0
Singling		9	0
8 irrigations		10	0
Upkeep (weeding, etc)	6	2	0
Picking	1	18	0
Various	1	5	0
Total	£ 16	10	0

The Cultivation of Paprika Pepper in America. — YOUNG, T. B. and TRUE, R. H. — *Bulletin of the U. S. Department of Agriculture*, No. 43, 24 pp. + 11 figs. Washington, D. C., December 16, 1913.

Paprika is a pungent red pepper obtained by grinding the fruits of ungarian variety of *Capsicum annuum*. The Spanish variety known as miento" or " pimienton " is distinguished from it by being sweeter less pungent. The quality of paprika depends on its colour, pun-y, swetness and flavour. The colouring matter occurs in the " shell " of fruit and is preserved in the final product by grinding it with the seeds, h contain an oil in which the colouring matter is soluble. The pun-y is due to a crystalline substance known as capsaicin (C_9 H_{14} O_2), d only in the placentae of the pods. The degree of pungency of the uct depends therefore on the extent to which the placentae are in-ed in grinding the fruits. Comparative tests of the degree of pungency made by determining the proportion of finely ground sugar required e added to cause the pungent taste to just disappear.

Experiments with different samples showed that Hungarian paprika d in pungency from a ratio of 1 : 300 to 1 : 1360 of paprika : sugar. e-grown American samples were in general superior to the Hungarian les; their degree of pungency varied from a ratio of 1 : 500 in the case sample made from the shells alone to 1 : 19000 in the case of a sample e entirely from placentae.

The sweetness of the product is due to the sugar contained in the shells e pods. Analysis showed that dried shells contained 24.6 per cent. of se and 1.7 per cent. of cane sugar. Sun-dried pods from Texas showed 2.5 per cent. of glucose and 5.9 per cent. of cane sugar.

Cultivation. — As an annual, it is propagated exclusively from seed. The of pods is determined by the length of the growing season. In the imental area in South Carolina the growing period is from 230 to 240 days a mean summer temperature of 78° F. Abundant sunshine adds brilli-to the colour and assists in bringing about a uniform ripening of the

The average yield and profits for four years are given below :

Average yield per acre	Price per pound	Total income per acre	Average cost per acre	Average profit per acre
1092 lbs.	9.3 cents	$ 102.23	$ 31.97	$ 70.26

The items of expenditure in the production of the crop include :

Preparing and sowing the seed bed.
Preparing and cultivating the land.
Transplanting plants to field and resetting to stand.
Fertilisers.
Picking the fruits.
Handling peppers, care of fires during curing, etc.
Fuel (pine wood).
Grading, sacking, handling, etc.

The cultivation of this crop would be profitable under present con tions, but any considerable increase in the supply would reduce the mar value of the product.

344 - **Ornamental Hibiscus in Hawaii.** — WILCOX, E. V. and HOLT, V. S. in *Ha Agricultural Experiment Station, Bulletin*, No. 29, pp. 60 + 16 coloured plates, nolulu, December 1913.

The writers describe the treatment and propagation of hibiscus, which about 500 varieties or sub-varieties exist in Hawaii, 240 of them be of some interest.

345 - **The Pollination of the Sweet Cherry** (1). — GARDNER, V. R. in *Oregon A cultural College Experiment Station, Division of Horticulture, Bulletin* No. pp. 3-40. Corvallis, Oregon, August 1913.

Experiments on the pollination of sweet cherries showed that all varieties tested were self-sterile and that inter-sterility is an import factor determining the success or otherwise of cherry growing.

No evidence has been obtained to show that inter-sterility is corre ted with closeness of relationship. The potency of any particular riety of pollen appears to be considerably influenced by environmen factors.

The grafting of inter-fertile varieties is recommended for the impro ment of the yield of orchards containing single or inter-sterile varie For immediate results, recourse may be had to placing branches of suita varieties in buckets of water in the orchards during the blossoming per and the encouragement of beekeeping.

346 - **Frost Protection in the Limoneira Lemon Orchards.** — CULBERTSON, J. (Assistant Manager Limoneira Company) in *Monthly Bulletin of State Commissi Horticulture*, Vol. III, No. 1, pp. 1-8. Sacramento, Cal., January 1914.

Experiments have been carried out in the lemon orchards of Limoneira Company, Santa Paula, California, on the use of coal and fuels, as a means of preventing frost injury.

Oil gave the best results as regards both efficiency and cost of labo Though the fruit was badly sooted, the trouble of washing with cheap rosene and soap wash was more than compensated by the success of the cr Each tree was protected by an oil pot, and the temperatures in differ parts of the orchard were recorded at the central station by means telephone system. The best type of oil pot was found to be one fitted w a "down-draught" tube, either perforated or slit, so as to maintain ample supply of air at the surface of the burning oil.

(1) See also No. 133, *B.* Feb. 1914.

Cost and maintenance of equipment for an orchard of 500 acres.

	$
50 000 oil pots	50 000
2 steel storage tanks of 5 000 barrels capacity	4 885.89
2 cement reservoirs of 100 000 gallons capacity, equipped with pump.	3 000
5 miles of 3 inch and 4 inch pipe line	6 375.03
35 tank wagons and tanks	4 315.00
150 spout pails for filling pots	300
200 torches	200
50 thermometers	150
4 miles of telephone system	750
350 000 gallons of oil in orchard at 2 1/2 cent	8 750
500 000 gallons of oil in storage at 2 1/8 cents	12 500
Total investment for 500 acres	$91 225.92

The annual interest, deterioration, and maintenance expense per acre, luding cost of operating, is as follows:

	$
6 % interest on total investment	10.94
15 % deterioration on on $ 100 worth of pots	15.00
6 % deterioration on balance of equipment	2.40
Estimated maintenance: handling, painting, filling	5.00
Total	$33.34

The writer points out that the danger of a deficit is far more serious n a possible lessening of profits in attempting citrus growing in cold as.

- **A Trial of Orange Stocks at Peshawar.** (N. W. Frontier Province, India). — BROWN, W. R. in *The Agricultural Journal of India*, Vol. IX, Part I, pp. 84-86 + 4 plates. Calcutta, January 1914.

Four different varieties of citrus are used as stocks for budding the lta and Sangtara oranges north of Delhi, *viz*: 1) the " mitha " or sweet e, said to produce sweet thin-skinned fruit; 2) the " khatti " or small r lime, on account of its vigour; 3) the " khatta " or large sour e, and 4) the " gulgul " or coarse citron, for inducing early growth and turity.

Experiments at Peshawar showed that Maltas grow best on the hatti " stock, while Sangtaras are more successful on the " mitha " gulgul " stocks. Further experiments are required to determine the stocks for other localities, and for developing such characters as flavour, ness of skin, date of ripening, early fruitfulness, length of days and er to withstand excessive irrigation.

- **Chestnut Hybrids in America.** — VAN FLEET, W. in *The Journal of Heredity*, Vol. V, No. 1, pp. 19-25 + 5 plates. Washington, D. C., January 1914.

Since 1894 numerous crosses have been made between Asiatic, Euro- and American species of chestnut. All hybrids derived from

Castanea americana were found susceptible to the destructive bark dis *Endothia parasitica.*

The most promising results have been obtained in crosses between American chinquapin (*C. pumila*) and the Japanese chestnut (*C. crenat* These hybrids form vigorous, small, much-branched trees, rarely shrul and come into bearing at from 3 to 5 years old. They bloom profus and the burs are borne in clusters or racemes of 3 to 5 or more, containi nuts intermediate in size between those of the parents. The nuts ha none of the starchy and tannin-like flavours so common with Europe and Asiatic chestnuts, but are not so sweet as the wild chinquapin.

The disease-resistance and early fruiting of these hybrids gives the great promise from a horticultural point of view.

LIVE STOCK AND BREEDING.

349 – **Effect of Smoke on Stock Farming.** — *The Journal of the Board of Agricult* Vol. XX, No. 10, pp. 896-898. London, January 1914.

In connection with the investigations being carried on at Leeds Un versity on the effect of atmospheric impurities on vegetation, an enqui was addressed to the farmers of the district with regard to the effect of to smoke on stock farming. The results show that a polluted atmosphe is deleterious to both cattle and horses; young stock do not thrive, and adu stock require more food and greater care than similar animals in a less co taminated atmosphere, the ill effects being due partly to the direct resp ration of the smoke-laden air, and partly to the effects of the smoke on t grass. Sheep are rarely seen in these districts, as, in addition to the dif culties of rearing and fattening stock, the depreciation in the market val of the animals as a result of the blackening of the wool by smoke has to l taken into account.

The harmful effect of a smoky atmosphere seems to be cumulati from generation to generation.

350 – **A Preliminary Report on the Investigations of Bovine Red Water (Cys Hematuria) in Washington.** — KALKUS, J. W. — *State College of Washingt Division of Veterinary Science, Bulletin* No. 112, pp. 1-27. Pullman, Washingt October 1913.

Cystic Hematuria is a local disease prevalent amongst dairy cows the western part of Washington State, especially on rough, hilly ground. is sporadic and characterised by a constant or periodic discharge of blo in the urine and by vascular lesions on the mucous of the bladder. Blo from an affected animal produced no ill effects when injected into a healt animal, but the disease was transmitted by inoculation with the bla der lesions, though no causative organism has so far been isolated. Th disease is chronic; some drugs seem to afford temporary relief, but affecte cows usually succumb eventually.

Comparative Histology of Alfalfa and Clovers. — WINTON, K. B. in *The* *anical Gazette*, Vol. LVII, No. 1, pp. 53-63, + 8 figs. Chicago, Ill., January 1914.

owing to the growing importance of alfalfa and clovers as feeding stuffs heir suitability for grinding into meal, a means for their microscopic fication is required.

he highest feeding value of the hay or meal is obtained from plants arly in flower, though more or less mature fruits and seeds are not uently found in the products on the market, especially in alfalfa meal. n a coarsely ground product, fragments of leaves, flowers, pods and may be picked out and identified; but when powdered the unicellular and crystals are the most conspicuous elements. Red clover may be guished from alfalfa and alsike clover by its larger, stiffer and more rous unicellular hairs arising from a swelling of the epidermis ; alsike from alfalfa and red clover by the less distinct warts on the unicel- hairs.

he cell-walls of the epidermis of the leaf are also characteristic, those ike clover being straight, of alfalfa simply wavy, and of red clover sinuous with projections at the angles and about the stomata.

he characters for identification may be summarised as follows :

	Alfalfa	Red Clover	Alsike Clover
epidermis af.	Wavy walls.	Deeply sinuous walls with projections at angles and about stomata.	Straight walls.
ular hairs.	Average diameter 15 μ; warts prominent.	Average diameter 30 μ; warts prominent, arising from epidermal swelling.	Average diameter 13 μ; warts indistinct.
r cells.	Less than 35 μ high, outer ends rounded.	More than 35 μ high, outer ends flattened.	More than 35 μ high, outer ends rounded.

A Note on Sex Determination. — (Contributions from the Zoological Laboratory of the Museum of Comparative Zoology at Harvard College. No. 245). — RGER, G. H. in *Science*, Vol. XXXIX, No. 997, pp. 215-216. New York, bruary 6, 1914.

collecting a series of data to show the relation of the size of litters number of nipples in swine, the records noted the position occupied e young pigs in the uterus, and it has therefore been possible to com- he products of one ovary with those of the other. Pairs of young mmediately against the ovary in the right horn of the uterus, similar in the left horn, and pairs at the junction of the horns were tabulated ling to whether they consisted of males only, of females only, or of and females, the observations extending over 2600 pairs of unborn

pigs. In all three positions the frequencies of the pairs were approxima in the ratio of :

25 per cent.	males only
25 » »	females »
50 » »	males and females

showing that in the pig the ovaries exert no influence on the sex of th spring by virtue of their position in the maternal body.

353 – **A Further Study of Size Inheritance in Ducks, with observations Sex Ratio of Hybrid Birds.** — PHILLIPS, J. C. (Bussey Institution) *Journal of Experimental Zoology*, Vol. XVI, No. 1, pp. 131-148. Philadelphia January 5, 1914.

As the result of crossing Rouen ducks with domesticated mallard races dissimilar in size but derived from the same wild species), the w of adult birds showed an increased variability of the males in t generation, while the variability of the females remained practical same as in the F_1 generation. No evidence was obtained in favour existence of simple and definite size units in the birds. A disturbe ratio occurred among the F_1 generation, resulting in a preponderan males almost in the proportion of two to one, but equality in sex nu was reestablished in the F_2 generation. Owing to the fact that investigators have expressed a doubt as to the Rouen colouring homozygous, the writer mentions that he obtained no evidence to th trary in his experiments.

A number of growth charts are given and discussed.

354 – **Rudimentary Parthenogenesis in the Golden Pheasant.** — LÉCAILLON *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 158, pp. 55-57. Paris, January 5, 1914.

The writer had already remarked that unfertilized hens' eggs traces of rudimentary parthenogenesis. He has made investigations o fertilized eggs from a hen golden pheasant (*Chrysolophus pictus*) to fin whether the same applies to this species.

In the egg of this species, as in that of the hen, the cicatricula two distinct zones : a dense central one, and a peripheral one cont vacuoles of air. In unfertilized eggs the cicatricula is much smaller th fertilized ones ; this is due to the fact that in an unfertilized egg the tricula spreads less over the yolk while passing through the oviduct. the microscope the dense part of the cicatricula shows blasto of varying size and of lenticular shape ; it is difficult to determine number; in the peripheral part no subdivision of the cells can be deter The blastomeres are composed of cytoplasm and deutoplasm and co normal nuclei. They are therefore cells which have undergone tr vision, and not simply products of disintegration of the germinal vesicle the same time, as in hens' eggs, the nucleus is only visible in recently eggs.

The degeneration of the blastomeres is often characterized by hyper-
y of the nuclei, again as in hens' eggs; these nuclei form numerous fresh
i of various sizes by budding.
The formation of the vacuoles in the peripheral part of the cicatricula
place in the golden pheasant's egg in the same way as in the hen's
but in this part the degeneration of the deutoplasm takes place less
ly than that of the nucleus.
These observations strengthen the idea that unfertilized eggs always
a tendency to develop like fertilized ones.

**Some New Varieties of Rats and Guinea-Pigs and their Relation to Pro-
lems of Colour Inheritance.** — CASTLE, W. E. (Harvard University) in *The
erican Naturalist*, Vol. XLVII, No. 566, pp. 65-73. Lancaster, Pa., February 1914.
Attention is drawn to the appearance in England of two new colour
ties of rats, *viz.* (*a*) pink-eyed yellow, fawn, or cream and (*b*) black-
yellow, fawn, or cream. Both varieties originated in the wild state
were possibly introduced by ships from abroad. In captivity they
bred successfully, and both proved recessive when crossed with the
race. The writer discusses some of the breeding results communi-
l to him by the fanciers who are in possession of the above animals,
the relation of these results to colour inheritance amongst mammals
neral.

"Dominant" and "Recessive" Spotting in Mice. — LITTLE, C. C. (Bussey
stitution, Harvard University) in *The American Naturalist*, Vol. XLVIII, No. 566,
p. 74-82. Lancaster, Pa., February 1914.
A wild mouse with a 'blaze' on the forehead was crossed with a dil-
rown individual which had been closely inbred. All the F_1 generation
bled the wild parent in coat colour, but had no trace of white. The F_2 ge-
tion contained animals of three types, *viz.*: I) self-coloured, II) those with
ze, and III) those with a few white hairs on the forehead. Animals
pe III, bred *inter se*, again produced the three above types, as did those of
II, though in this case the self-coloured animals produced only amounted
per cent. Thus while spotting behaved as a *recessive* in F_1, it behaved
dominant in certain of the F_2 individuals; yet, as the spotting character
from a single individual, it appears improbable that it should be of
distinct types.
The writer discusses his results together with those of Miss Durham
Hagedoorn, and concludes that dominant spotting is not caused by
resence of a factor restricting pigment formation in certain areas which
sent in the 'self' colour; neither can the presence and absence hypo-
s account for the changing dominance which he observed, and which
ttributes to a modification of supplementary factors.

257 – **Stock Breeding in Southern Italian Somaliland.** — Scassellati-Sforzo Giuseppe, pp. 242 + 62 ill. and 1 map. Rome, 1913.

The climatic and geological conditions of the Protectorate of South Italian Somaliland (1) are on the whole well suited to stock breeding, the varying somewhat from place to place. This industry is the only so of income from agriculture, and the animals raised are chiefly cattle, sh goats, camels and donkeys. The herds of cattle graze upon the rich tile meadows on the alluvial soil (*harra medou* = black soil) along the ri Juba and Shebeli, while the camels are kept upon the less fertile alluv (*harra gudud* = red soil) of the river valleys, and on the dunes (*harra* = white soil) which stretch along the sea-shore. Sheep graze after the ca and goats after the camels. There are no statistics as to the numb stock in the Protectorate; but the writer estimates the numbers in at 764 000 cattle, 216 000 sheep and goats, and 305 300 camels and c domestic animals. In comparison with the other African colonies, thern Italian Somaliland seems to be fairly well stocked.

I. *Breeds of Cattle.* — There are four breeds of cattle in the Prot rate, all of which are zebus: the Macien or Surca, the Gasara, the Da and the Magal. The two former are somewhat less primitive than the latter.

Macien breed. — These are long-horned animals, probably from E pia, and are also found in British East Africa. Colour usually red, se white, never black, often mottled with yellow; head and neck nearly alw red; a white line above the nostrils and round the ears is characteristi muzzle and hoofs yellowish to red. Hump low but very wide; dewlap a sheath of bulls very prominent. Skin generally coarse. Profile nea straight; forehead broad and flat or slightly dished; ears medium-sized, slig ly drooping. Limbs fairly well set on; rump sloping. The height at withers averages 4ft. 2 in; horns 16 to 20 in. long. The live-weight o bull in average condition is about 880 lbs., while that of a fairly good c is about 660 lbs. Sexual dimorphism is very conspicuous in this breed. cow gives little milk, but the fat content of the latter is high. It is a g beef breed.

Gasara breed. — These animals are short-horned, frequently hornless with small cylindrical horns. Colour originally white, but pure-bred wi individuals are rare; they are generally spotted with black and red; mu and hoofs black, as also the tip of the tail. Hump higher than bro dewlap and sheath rather prominent in animals which are not pure b Skin thin and fine. Face distinctly dished; forehead not very bro ears larger than in the Macien and horizontal. Position of legs good to good. Rump less sloping, and sexual dimorphism less strongly marked t in the Macien. Height at withers about 3 ft. 10 in.; horns up to 8 Live-weight of a cow in average condition about 550 lbs., of a bull 660 lbs. The cows are excellent milkers. The breed is susceptible to typ

(1) The area of the Protectorate was about 12000 sq. miles up to March 1912, a further 62000 sq. miles were added; the studies were made from September 19 June 1912, and therefore chiefly relate to the area annexed before March 1912.

asis, but this disease is not of frequent occurrence. The Gasara breed idely spread in Southern Italian Somaliland, including the dunes the coast, and is also found in British Jubaland.

Dauara breed. — The writer believes this breed to be derived from a between the two previously mentioned. There are occasional very animals with small black horns. Colour whole chestnut. Dewlap, h and purse very prominent. Hoofs black. Tip of tail reddish. long. Skin very fine, forming folds at the neck. Udder of cows large. cattle are suitable for both milk and beef production.

Maga breed. — Short-horned, small and badly-shaped. Colour black, ften flecked with white on head and body. Hump very large. Head with dished forehead. It is not a favourite breed owing to its poor rmance and its black colour.

I. *Camels.* — These are exclusively one-humped ; the Somalis divide into several races by their colour.

II. *Goats.* — These all belong to one type; the height at the withers is 30 in. and the live-weight 55 to 88 lbs. They are usually white, seldom nd never black; generally pied, particularly white with head, legs and pe down the back red or black; red-headed animals generally have two stripes running from the eyebrows to the nostrils. Ears fairly long, ht or slightly drooping. Sexual dimorphism marked: males have the large and the neck thick, and backwardly curved horns; along the back is usually a strip of silky hair. The females are more slightly built, and a well shaped udder. The Somalis distinguish two breeds: a long-eared or milk and a short-eared one for meat production.

V. *Sheep.* — These, like the goats, all belong to one type. The height e withers is 26 to 28 in. and the live-weight 55 to 88 lbs. Body white, head generally black, but not infrequently red, or white like the rest e body. Face strongly dished ; small horns sometimes occur in the but the ewes are always without them ; ears long and drooping. Somali sheep has no wool, and is a fat-rumped species belonging to roup of *Ovis steatopigia* or *ecaudata*.

I. *Donkeys.* — These are descended from the Somali wild breed (*Equus s somali*) and are much lihe the Abyssinians. They are slate-grey and 9.2 to 11 hands high. Head heavy, face dished ; ears smaller than in European donkey. Herds of donkeys are very little kept.

Mules are of very secondary importance ; as there are no horses, all nported from Eritrea and Abyssinia.

There are very few *ostriches, fowls* or *bees*.

II. *Methods of stock-keeping and rearing.* — In the neighbourhood of es where there is a constant market for milk and meat, a certain num- f cattle are kept stationary; during the day they graze near the village t night are shut up in enclosures called *zeribe* ; in the dry season they imes get a little fodder. Otherwise the herds migrate from place to according to the condition of the pastures.

The Somalis make some attempt at selecting their bulls ; only the finest ared, and eventually those producing good daughters are kept on as

sires. On the other hand all heifers are put to the bull, the reason b
that milk and veal are the chief foods of the natives. Bulls come into se
at 2½ or 3 years, while the heifers are put to them at 2 to 3 years.

The calves are weaned at 4 or 5 months, which is decidedly too s
especially as their dams are also milked.

The Somalis have no knowledge of hay- making. When the rivers
springs dry up, they dig wells for watering the cattle.

VIII. *The economic value of the stock and its products.* — The valu
the stock to the natives depends chiefly upon its milk and meat produc
The camel is prized for both these reasons, and also for the work it
forms. The daily milk yield of a fairly good cow is about 5 quarts, a
she-camel will give this amount besides what the calf takes. The pri
milch animals depends on their yield ; a good cow fetches from £ 3 to £ 5
a very good milch camel from £ 4 to £ 5. Cow's milk is sold at 9*d* a g
and camel's milk at 4 ½ *d*. Superfluous milk is made into butter, and
and the skim milk are favourite foods; the price of butter is about 8*d* p
Most of the butter exported goes to Arabia and Zanzibar. The am
exported has fallen from 500 000 lbs. in 1905-06 to 145 000 lbs. in 1911-12

The meat production, although chiefly destined for home consump
is already considerable. The natives like to turn to account all othe
useless animals by slaughtering them for food. The Macien breed i
most suitable for fattening owing to its early maturity. The price of
for the butcher varies with the weather and the diseases prevalent.
present, a good fat ox fetches 19 *s* to 35 *s*, while the price of an average
is 6*s* to 8*s*.

The price of meat continually varies with the price of the an
slaughtered; at Jumbo and other coast towns beef costs about 1 ¾ *d* p
and at Gelib only a little over 1*d* per lb. A pound of mutton costs 3
at the first-named places. The entire trade in meat and animals fo
slaughter-house is a monopoly of the Arabs, Indians and natives, who sh
superfluous cattle to Aden, Mombasa and Zanzibar. Table I shows th
portance of the export trade in animals for the slaughter-house from
to 1912.

TABLE I.

Year	Cattle		Sheep and Goa	
	Number of head	Value £	Number of head	Val £
1905-1906.	1 751	2 602	10 272	23
1906-1907.	1 727	2 643	9 157	16
1907-1908.	3 295	2 600	7 733	17
1908-1909.	1 959	3 758	8 280	19
1909-1910.	1 507	2 678	7 361	18
1910-1911.	1 694	4 356	7 642	21
1911-1912.	1 943	3 896	7 113	19

nimals are little used for work, except camels. Only one or two hun-
amels are exported annually, at from 47*s* to 55*s* per head. More
iant articles of export than draught animals are hides, of which the
ing numbers were exported between 1905 and 1912:

Ox hides	to the	value of	£ 18061
Camel skins	» »	»	» £ 729
Sheep and goat skins	» »	»	» £ 10735

The value of the ostrich feathers annually exported amounts to some
reds of £.

IX. *Encouragement given by the Government to stock-breeding.* — The
rnment has founded an inoculation station where animals are ino-
ed in order to protect them from the more dangerous diseases. Up
e present, many thousands of cattle have been successfully treated,
e great satisfaction of the natives. Further, the Government has issued
lations for the protection of grazing concessions (extending over 10
s) and the use of pastures. At Merca, a Stock-breeding Station (Sta-
sperimentale d'incrocio e di selezione) has recently been established;
s already been supplied with different native breeds of cattle, and has
lself the task of finding out the best breeds, and the most suitable
ling methods. By a Decree of September 12, 1912, a department was
ituted in the local colonial administration to take charge of stock-breeding
zione dei servizi zootecnici).

Stock breeders' tasks. — According to the writer, the chief aim of the
breeder in Southern Italian Somaliland should be the production
at for exportation to Italy. This is impossible at present, for the condi-
requisite for obtaining a large supply of cattle are wanting. If, how-
certain measures were carried out, the Colony would easily be able
ake up the deficiency in the meat supply of the Motherland. Such mea-
would include:

1) The improvement of the breeds of cattle by means of selection,
ethodical crossing, and the changing of the grazing methods of the
es.

2) The establishing, in one of the coast towns of the Colony, of a
ty with large capital, which would be in a position to take over the
and meat trade.

3) The improvement of the communication with Italy and the pro-
g of the ships with cold-storage chambers for meat.

The Government, on its side, must take effective measures for the con-
of diseases. This will be best done by turning the Inoculation Sta-
nto a modern institute for serum preparation, and making a quarantine
on the coast. In addition, the writer requires that the Government
d create a bureau of information on stock breeding and an experi-
al stock farm, mainly for the assistance of the Italian colonists, who
till few in number.

Lastly, the writer counsels the acquisition of only large ranches, say
0 acres, which should be devoted to meat production. According to

careful calculations, such a farm, after a few years, could supply ann to the meat market at a high profit 400 head of cattle and 1000 la The production-cost per 100 lbs. of meat would be about 22s 9d, tha relatively little.

358 – **The Condition of the Breeders' Associations in Germany in 1912.** – Kn Oskar in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year 28, No pp. 687-690. Berlin, December 20, 1913.

The following tabular summary gives the objects and number of Breeders' Associations in Germany, the number of registered animals the numerical increase (+), or decrease (—), for the year 1912.

TABLE I.

Breeders' Associations for:	Number of Associations	Animals registered	Increase (+) or decrease (—) in the num of 1912 a compared wit preceding y
Horses	246	65 187	+ 15
Cattle.	1 627	410 953	+ 12 9
Sheep	9	4 542	—
Pigs	171	19 729	+ 1
Goats	916	55 108	+ 7
Total . . .	2 969		

In comparison with the preceding year, 1912 shows an increase o associations, of which 16 are devoted to horses, 45 to cattle, 1 to and 235 to goats; the pig-breeding associations have decreased by 4

The largest number of registered horses is to be found in Han where 9 658 head are entered. Schleswig-Holstein takes the lead as re cattle, with 54 362 registered, while Brandenburg heads the list for with 3 040 and Hanover for both pigs and goats, with 6 916 and 2 respectively.

The registered animals all belonged to the following breeds:

TABLE II.

Division and Breed.			Nu of An
Horses	German Thoroughbreds . . .	stallions	
		mares	
	Draught horses	stallions	
		mares	

Division and Breed.			Number of Animals.
	Mountain cattle	bulls	10 297
		cows	118 380
		heifers	14 325
	Lowland cattle (including Shorthorns)	bulls	14 212
		cows	239 545
		heifers	14 194
	German Improved pigs	boars	333
		sows	1 856
	unimproved native pigs	boars	94
		sows	340
	improved native pigs	boars	2 974
		sows	13 817
	other breeds	boars	42
		sows	273
	White Saane breed	males	1 942
		females	31 596
	Coloured breeds	males	597
		females	21 071

Calf-Feeding with Blatchford's Calf Meal. — GIULIANI, RENZO in *Annuario della Istituzione Agraria Dott. Andrea Ponti*, Vol. II, pp. 37-50. Milan, 1914.

Blatchford's Calf Meal is a greyish red, not very homogeneous meal with a pleasant favour; it contains 45.84 per cent. of nitrogen-free extract and 20 per cent. digestible protein. It is the product of an American firm, and is offered as a substitute for milk in rearing calves; 1 lb. of the meal in one gallon of water is regarded as the equivalent of one gallon of milk. The writer has lately carried out a rearing experiment at the Agricultural College at Milan upon five Bergamasco calves from six to twelve days old, in order to ascertain how far this substitute can actually replace milk. The animals were, for this purpose, divided into two lots; lot I consisted of two calves, and lot II of three. The calves were fed as follows:

Period	Lot I	Lot II
first	milk	milk
second	milk + meal	milk + meal
third	meal	milk (2 calves); milk + meal (1 calf).

In lot I, 1lb. of meal in a gallon of water was substituted for a gal of milk, while in lot II the amount was 2 lbs. of meal in a gallon of wat In the third period, the experimenter had intended to entirely replace milk (also in the case of lot II), but already at the close of the second per the calves refused the food, so that two of the animals were again given m while the third was fed as before. The rations were always measu according to the appetite and the live weight of the calves. The experim lasted 57 days in the case of lot I and 90 days in that of lot II.

Results: the health of all the animals was very good throughout first, or milk, period. The same may also be said regarding the first of the second, or mixed food, period. But the more milk was subsequen replaced, the greater the loss of appetite shown by the animals. The ves of lot I only readily took up to 21 oz. of meal, and those of lot II refu to eat more than 28 oz. In the third, or meal, period the appetite of calves of lot I decreased so much, that it was necessary to change the fo ing after a few days to prevent death. It was found impossible to substi meal entirely for milk in the case of lot II. During the time that were fed on meal, the calves were low-spirited and out of sorts and suffe from attacks of shivering and diarrhoea. The urine and faeces evacuated in larger amounts than usual; the faeces were always colou and contained particles of undigested meal. If the animals were a given milk, they regained their usual appearance after a few days. In case of both lots, the live weight decreased with the increase of the ration.

The results of the experiment lead to the conclusion that Blatchfor Calf Meal cannot entirely replace milk, either from the physiological the economic point of view. Physiologically, though not economical it can be used with success under some circumstances as a partial sub tute for milk.

360 – **Studies of the Irish Kerry Cow.** — FUNDWALL, E. in *Mitteilungen der k wirtschaftlichen Lehrkanzeln der k. k. Hochschule für Bodenkultur in Wien*, Vol. 2, Pa pp. 331-374. Vienna, November 29, 1913.

The writer first gives a detailed description of the climate and soi Ireland, and then speaks of the distribution, feeding, management, breed and performance of the Kerry cow. He then proceeds to describe the D ter, and subsequently gives the measurements of 19 typical skulls, compar the measurements with those of the skulls of the red Breton and Po breeds. In the last chapter, the writer gives a summary of the histor the Kerry cattle.

The study of the skull and body measurements of the latter reve their almost complete agreement, in these respects, with the *brachyc* red Breton and Polish breeds. The *brachyceros* characters were far m marked in most of the Kerry skulls examined than were the *primige* characters. The latter characters were generally only recognizable in formation of the forehead, the shape of the nasal and lachrymal bones, that of the temporal fossae.

he conclusion to be drawn is that the Kerry cattle are very nearly d to the red Breton and Polish breeds, and consequently, like these, t belong either to the *primigenius* or the *brachycephalus* (Werner) but should be included in the *brachyceros* group.

The Distribution of the Wild Sheep in relation to Watersheds. – OMANSZIK, RUD. in *A. Petermann's Mitteilungen aus Justus Perthes' Geographisches nstalt*, Year 60, February Number, pp. 70-72. Gotha, 1914.

he writer shows that the distribution of the 50 forms of wild sheep e Holarctic region is largely according to river-basins, watersheds ng the limits between the areas of neighbouring forms.

Pig Feeding Experiments. — MEYER, G. and FINK, E. in *Sonderabdruck aus itteilungen der Vereinigung Deutschen Schweinezüchter*, 6 pages. (undated).

n the year 1913, at the suggestion of the "Vereinigung Deutscher einezüchter", a ten weeks' feeding experiment with 260 pigs of the im- d local breed, weighing uniformly about 148.5 lbs., was conducted, with ief object of judging the relative value of dry and moist feeding (1). The ls, which were fed according to their appetites, were divided into en lots of twenty each. The dry food was supplied by a Thimann's od automatic feeder; the moist food was given as a stiff paste.

he results of the first eight lots, in which four different mixtures of were compared with each other, are shown in Table I.

n this table only the cost of the food is considered; all the other factors, s cost of management, rent of sties, as well as the value of the manure ced, have been omitted.

TABLE I.

od given	Fed moist				Fed dry			
	Increase	Consumption of food	Cost of food	Cost of 1 lb. of increase	Increase	Consumption of food	Cost of food	Cost of 1 lb. of increase
	per day, per pig				per day, per pig			
	lb.	lb.	*d*	*d*	lb	lb	*d*	*d*
, (*) 1/3 barley 1/3 potato flakes ol meal	0.93	4.27	3.6	3.9	1.03	4.95	4.2	4.1
groats, Fatting- ain blood food .	0.96	4.87	4.1	4.2	0.96	5.13	4.3	4.5
roats, blood meal	0.99	4.81	3.9	4.1	0.91	5.03	4.2	4.6
groats, fish meal	0.89	4.85	3.9	4.4	1.00	5.74	4.8	4.8
Average . . .	0.94	4.66	3.8	4.1	0.97	5.21	4.3	4.5

(*) Preparation of maize.

(1) See No. 1270, *B.* Nov. 1913. (*Ed.*)

With the dry food, the pound of increase of live weight costs a more than with the moist food. On examining the records of the sep weeks it is found that in some weeks dry feeding was more advantag and in others moist. The final result is not therefore absolutely able, as it would have varied had the experiment been stopped at an date. Nevertheless it may be stated that the two ways of feeding cost a the same. As for the mixtures of food, the writers observe that the mixture seemed to suit the pigs particularly well, though the other caused a normal development of the animals.

Table II contains the results of the five remaining lots, in which different food mixtures were compared. The first four mixtures were moist and the fifth dry.

TABLE II.

Food given	Increase	Consumption of food	Cost of food	Cost o of in
	per day and per pig			
	lb	lb	d	
Axa and blood meal.	0.63	4.22	3.6	5
1/2 Axa, 1/2 barley groats + blood meal.	1.42	5.19	4.3	4
1/2 Axa, 1/2 barley groats + blood meal	0.98	5.06	4.2	4
1/4 Axa, 1/4 barley groats, 1/2 potato flakes + blood meal.	0.93	4.42	3.7	4
Barley groats and dry yeast	1.14	5.41	4.4	3

The mixture of Axa+bloodmeal was not a great success; the an did not seem to relish it much and remained inferior to the others diminishing the amount of Axa fed, the animals showed more appetit regards the other mixtures, it is to be noted that potato flakes alway duced after a short time a feeling of satiety, and that dried yeast, t at first not willingly taken, proved a good and wholesome food.

At the butcher's test no difference could be detected between th of the pigs that had been fed dry food and the flesh of the others. Too Axa food made the fat softer and slightly yellowish.

363 – **Early Identification of Good Hens.** — WILSON, J. (Royal College of Dublin) in *Journal of the Department of Agriculture and Technical Instruction land*, Vol. XIV, No. 2, p. 240. Dublin, January 1914.

An important observation has been recorded in connection wi egg-laying competition at the Munster Institute (Cork). It was foun a hen's total egg yield for the year could be predicted from her perfor during the first eight or ten weeks of the laying season (November, D ber, January). Good layers laid about five eggs a week, very s

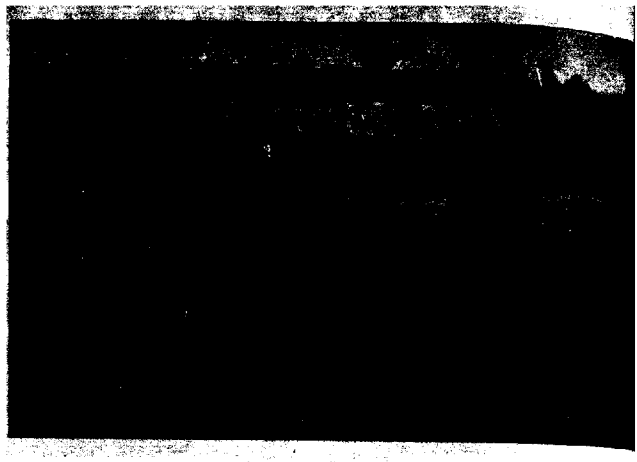


Fig. 1.

g two successive blank days, and continued at this rate for eight or ten
. Medium layers had blanks of several days at a time, or did not
a continuous steady yield during the same eight or ten weeks, while
ayers laid very few or no eggs during the period.

FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

The Shuman Sun Power Plant. — *The Implement and Machinery Review*, vol. XXXIX, No. 467, pp. 1515-1517. London, March 1, 1914.

he direct utilisation of solar energy for the production of mechanical has long presented an interesting problem. One practical solution has been found by Mr. Frank Shuman of Philadelphia, who has been rk upon it for the last seven years. He has now in operation near Egypt, the sun-power irrigation plant shown in the accompanying ations.

t consists primarily of five heat absorbers, a 100 HP low-pressure con- g engine and a reciprocating pump. Fig. 1 is a view of one of the heat bers and Fig. 2. shows two of them in a tilted position. The absorbers ng the boilers are set due north and south on rollers and gears on con- foundation posts, and are slowly turned so as always to face the sun. are 200 ft. long, and 13 ft. wide at top, and consist of light parabolic s set with silvered mirrors which catch and reflect the heat of the sun the long flat-bottomed boilers suspended in the line of foci of the rs. The steam, which is not allowed to rise above one atmosphere re, is collected by a 3 ½ inch pipe running along the whole line, e it is conveyed to the engine by the main steam pipe. After its work the steam in the engine is condensed into water and pumped into the boilers; the danger of clogging the boilers with mud or is thus minimized.

he cost of power production by this system is claimed to be equivalent ng coal at 9s 8*d* per ton, whilst in Egypt and the Sudan the price of s given as over £ 3 per ton.

New Rotary Tilling Machine: The "Motoculteur." — *Les Inventions Illus-*, Year 17, No. 2, p. 7. Paris, January 20, 1914.

he main feature of this machine is a rotary digger with flexible claws. vantages are lightness, great facility of management, and the uniform mplete working of the soil at one operation.

he following are the official returns of crops grown at Grignon on worked by this machine:

	Total weight	Straw	Grain
	lbs.	lbs.	lbs.
With 178 lbs. of seed per acre	8080	5590	2490
» 107 » » » » »	9150	6650	2500

his machine, destined for vineyards and market gardens, is built by Société de la Motoculture Française" in Paris.

366 – **The "Detroit" Rein-Steerage Gasoline Tractor.** — *The Implem Machinery Review*, Vol. XXXIX, No. 467, p. 1520. London, March 1, 1914.

Great economy of agricultural labour is effected by several r machines; thus some motors and binders have been built, two of whic be driven by one man.

Recently the Detroit Tractor Co., Detroit, Michigan, U. S. A., built a tractor which is controlled by the man sitting on the reaper, p or whatever implement is being operated, the tractor being driven, l team of horses, by reins.

The steering is accomplished by a pull on the right or left steering A pull on both reins stops the engine. The third rein moves the gears a neutral position to "forward" or "back" and, exceptionally, in country, a fourth rein is used to work the brake.

367 – **Ditch-Excavating Machine.** — *Engineering Record*, Vol. 69, No. 1, January 3, 1914.

The F. C. Austin Drainage Excavator Company of Chicago have a ditching machine which cuts ditches of 5 ½ feet maximum depth v 5 foot bottom. The sides are cut with a 1 : 1 slope so that the max top width possible is 16ft. The traction is so designed as to permit th chine to turn a complete circle with one wheel stationary. The outfit trated is worked by a 50 HP gasoline engine. In ground composed alluvial soil the machine is claimed to have excavated 175 cu. yds. per The cost of operation is about $ 15 per day. The outfit can be operat one man.

368 – **New Machine for Renovating Grass Lands.** — FRANK in *Georgine, La Forstwirtschaftliche Zeitung*, Year 7, No. 6, p. 33. Königsberg i Pr., January 1;

Old or thin meadows are sometimes renovated by lightly working surface with tooth or disk harrows or similar implements and then casting grass seeds over them. Hitherto no implement existed which bined the least injury to the existing turf with the guarantee that seed cast reached the seed bed.

Such an implement, which may be called a «furrow-drill for grass has now been constructed and patented in the German Empire No. 261 242.

The feeding shaft is driven by an endless chain on the hub of the rear wheel. It is thrown into or out of gear by a clutch. The qu of seed is controlled by a feed regulating device which allows a range o 5 ½ to 22 lbs. of seed per acre. The furrow-openers and coulters are or lowered by a hand lever as in cultivators. The furrow-openers ar ened to a strong support, so that, as is shown in fig. 1 (in which *a* is the h opener, *b* the coulter), they penetrate to a depth of only 1.2 inch into th while the coulters cut 2 to 2 $^3/_4$ inches deeper; thus the seed do descend too deep into the soil and yet the latter is loosened to a greater and prepared for the reception of new roots. Experiments have show the seed drilled with this machine germinated very well. The dril situated 5 ½ inches apart. In some cases where thick sowing is desira grassland can be drilled a second time cross-wise to the first drillin

According to the depth of the work done, two or three medium horses e required to draw the machine, and 10 to 12 acres can be sown in

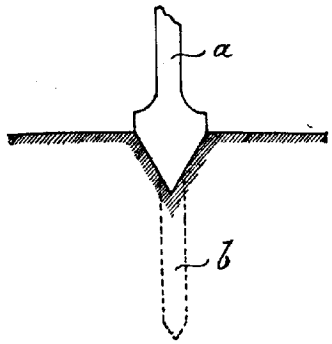


Fig. 1.

Grassland renovator. — Furrow-opener.

hours. Compared with other methods of renovating grasslands this plement saves much labour and seed.

The machine is built and sold by the Cooperative Machine Association Konigsberg.

- A New Appliance for Elevating Grain and Granular Goods. — GREINER, W. in *Zeitschrift des Vereines Deutscher Ingenieure*, Vol. 58, No. 4, p. 154. Berlin, January 24, 1914.

The new flexible metal tubing invented by Jacob Bros., of Zwickau i. S., fers essentially from the metal tubing hitherto used; the latter cannot used everywhere because its inside presents depressions or grooves in ich some of the stuff conveyed lodges, and thus increases the resistance the passage of the bulk of the same.

This new tubing is formed by two special steel or bronze bands wound irally and forming an outer and an inner pipe. The inside of the latter a succession of overlapping smooth surfaces. As packing, an asbestos cord wound round the tube. According to experiments, this tube allows the ssage of about 30 per cent. more grain than the old types in the same ne, and its duration is four to six times greater. The various lengths tubing can be joined to each other by flanges or conical couplings. The bing is manufactured in various sizes, the largest reaching 20 inches in ameter. For elevating grain or the like from the holds of ships it is made pecially light so as to be very flexible.

Figure 1 shows a side view of a piece of tube, Fig. 2 a section and Fig. 3 e tubing at work.

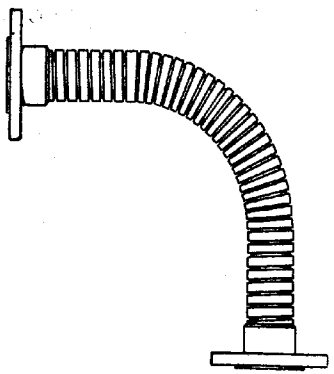


Fig. 1.

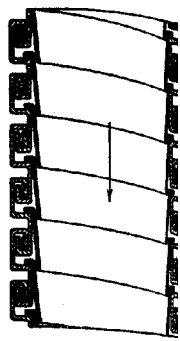


Fig. 2.

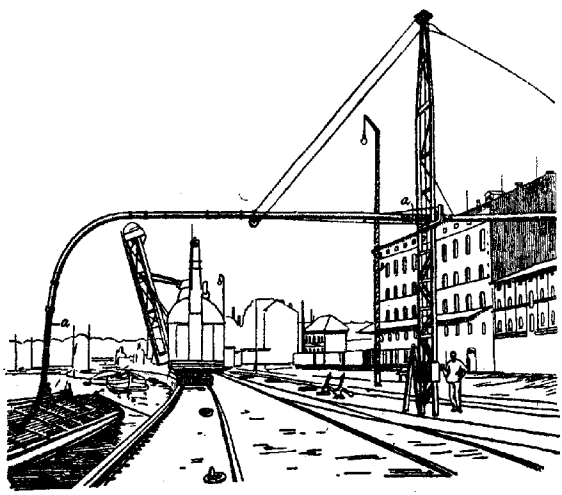


Fig. 3.

Grain elevator.

Process and Apparatus for the Extraction of Sugarcane Juice. — MENGELBIER, O. in *La Sucrerie indigène et coloniale*, Year 49, No. 1, pp. 3-7 + 1 figs. Paris, January 7, 1914; and Patent N. 549748.

The writer has invented a process and an apparatus for the improved action of sugarcane juice by means of mills. The invention consists of:

1. A process of extraction, the characteristic feature of which is that bagasse is first treated by steam (preferably in a chamber allowing of

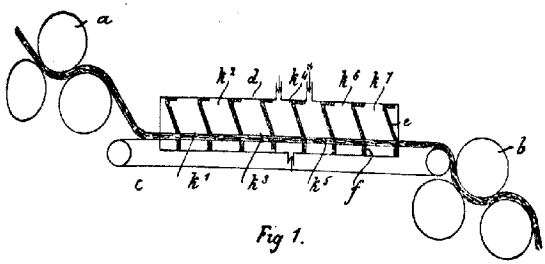


Fig 1.

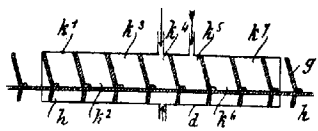


Fig 2.

Apparatus for the extraction of sugar-cane juice.

ntain pressure above that of the atmosphere so as to attain the temp- ure required to burst the cells of the outside layers of the cane and of hard knots), and then, in another chamber, supplied with the quantity iffusion liquid that is still necessary.

2. An apparatus for carrying out the process, the principle of which at the bagasse is conveyed between two pressings through a chamber ch is as air-tight as possible.

3. A detail of the apparatus consisting in placing before and behind principal compartments one or more compartments in which the steam escapes may condense upon the bagasse. This is done to avoid the s of steam due to the chamber not being sufficiently air-tight.

The accompanying figures show one form of the chamber consisting of ral compartments k^1 to k^7; a and b are sets of rollers, c is an endless

canvas conveyor or similar device for carrying the bagasse throu channel-shaped vessel *d*. In order to obtain approximately air-t chambers, shutters or partitions (*e*, *f*, fig. 1; *g*, *h*, fig. 2) are used ; they be rendered more air-tight by rubber strips or other similar material fig. 1 the partitions (*e* and *f*) are borne by the vessel *d*, while in fig. 2 (*g* and *h*) are carried by the endless conveyor and rub against the sides

Steam is introduced into the chamber k^4, where it warms the ba and penetrates into it ; part of the steam is condensed and part escapes the neighbouring compartments k^3 to k^2 and k^5 to k^7. In the fo it comes in contact with the cold bagasse, which it warms, whil steam which gets into compartments k^5 and k^7 is condensed by imbibition liquid which is introduced into k^6 and which is prefe already strongly heated ; this liquid, together with the condensed st causes the sugar to diffuse out.

371 – **Simon's "Star" Sack Cleaner.** — *The Implement and Machinery R* Vol. XXXIX, No. 465, p. 1211. London, January 1, 1914.

Sacks being employed in vast numbers, some wholesale mecha method of cleaning them is often required, and in such cases the Star Cleaner, shown in the accompanying figure (made by Messrs. Henry S Ltd., Manchester) appears to be invaluable. The sacks, 100, 200 or 3 a time according to the size of the machine, have simply to be thrown the revolving chamber. The sacks are not fixed or held in any way are tumbled about inside the drum, and after half an hour are cle unless caked inside, in which case they require turning. The dust and leave the machine through a wire screen round the drum.

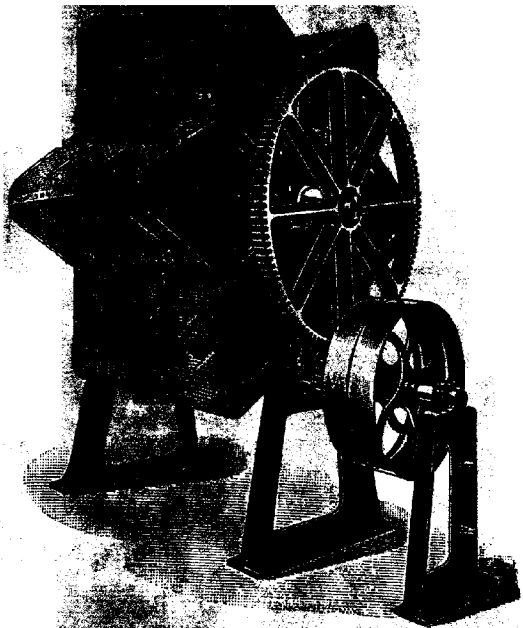
These cleaners have been adopted by many large flour mills and establishments which use sacks. They are built in three sizes. The le of the machines are 5, 7 and 9 feet respectively. The gross weights ar 60 and 70 cwt. The width and height of the machines are the sam each size, namely 8ft. 6 in. by 10 ft. 7 in.

372 – **A New Cattle Cart.** — *Deutsche Schlacht- und Viehhofzeitung*, Year 14, p. 68. Berlin, February 1, 1914.

The cattle cart shown in the accompanying figure is so constr that its back can be let down so as to form a bridge for loading or unlo cattle. In the same way the two front halves of the sides of the truck be let down as bridges; these bridges can also be placed in the doorwa railway cattle truck, so that the animals can go straight in from the

373 – **Mechanical Requisites in Cyprus** — *The Implement and Machinery* Vol. XXXIX, No, 467, p. 1500. London, March 1, 1914.

The tillage implements used in Cyprus have hitherto been of the primitive type. The Agricultural Department of Cyprus has been tryi introduce modern appliances by practically giving implements to some ers or by hiring out machines under easy conditions. As soon as growers were able to judge of the value of new farm requisites, the D ment withdrew from the market and left the trade to makers and a As a result of this policy the imports of these articles have grown ra



Hesser's "Star" sack cleaner.

in 1912 they amounted to £1175. The bulk of the trade is in English ds, but ploughs have been shipped from Russia and other implements n Germany and Austria. Some reapers and binders and threshing machines e been introduced, and wind engines are employed freely for irrigation poses. On the whole the country offers good promise for the future.

- Review of Patents.

Tillage implements and machines.

4 (Austria). Adjusting device for fore-carriages of cultivators and the like.
3 (Austria) Hoeing apparatus for agricultural motors.
3 (Austria). Appliance for increasing the adhesion of driving wheels in ploughing machines.
5 (Austria). Steering gear for ploughing machines with steering wheel.
79 (Belgium). Process for treating sandy and dry soils previous to cultivation.
20 (Belgium). Regulator for inclination of simple and double Belgian ploughs.
40 (Belgium). Handle attachment which can be applied to double Belgian ploughs.
48 (France). Planting and hoeing machine.
72 (France). Arrangement for shifting laterally the beams and shares of ploughs.
46 (France). Improvements in tilling machines.
67 (France). Motor plough.
83 (France). Cultivator.
12 (France). Improvement in double and single ploughs applicable to revolving or fixed beams.
17 (Germany). Motor plough with cleated wheels.
17 (Germany). Wheel with adjustable cleats for agricultural motor machines.
19 (Germany). Motor plough.
02 (Germany). Multiple-furrow gang ploughs.
03 (Germany). Cable with laterally adjustable rollers for motor balance-ploughs.
21 (Germay). Motor plough with rear steering wheel.
13 (Germany). Wheel with shovel ceats for motorcar for agricultural machines.
9 (United Kingdom). Land levelling appliance.
427 (United States). Plough attachment.
449 (United States). Attachment for cultivators.
761 (United States). Cultivator.
860 (United States). Gang plough.

Manure distributors.

4 (Austria). Device for regulating the quantity of manure spread by manure spreaders.
394 (Germany). Manure spreader.
863 (Germany). Manure spreader.
734 (Germany). Farmyard manure spreader.
801 (Germany). Nitrate of soda spreader.

Drills, sowing machines and planters.

569 (France). Change of speed for drills.
659 (Germany). Combined drilling and dibbling wheel.
6511 (United States). Corn planter.
7010 (United States). Cotton planter.

Mowers, reapers and harvesters.

372 (France). Attachment for raising the ears in harvesters and similar machines.
380 (France). Mower.
365 (France). Automatic mower.
353 (Germany). Three-wheeled sheaf binder.

24 872 (Germany). Harvesting machine.
25 152 (United Kingdom). Reaping or mowing machine.

Machines for lifting root crops.

64 050 (Austria). Potato harvester.
64 300 (Austria). Potato harvester.
262 259 (Belgium). Apparatus for topping beets.
262 271 (Belgium) Device for automatic raising and lowering of beet lifters.
261 789 (Belgium). Device for topping, lifting and carting beets, etc., and at the same t ploughing the soil.
24 737 (United Kingdom). Potato harvesters.
1 086 631 (United States). Beet harvesters.
1 086 563 (United Kingdom). Potato harvest machine.

Other agricultural machines and implements.

461 113 (France). Appliance for bimetallic sprayers.
461 403 (France). Apparatus for removing the upper layer from honey-combs.
460 417 (France) Instrument for cutting bunches of grapes.
460 659 (France). Forage drier.
269 354 (Germany). Hay tedder convertible into swathe rake.
269 482 (Germany). Differential steering for fore-carriages.
269 573 (Germany). Hummeller.
270 841 (Germany). Straw press binder with two pincer-like groups of arms working toget
271 753 (Germany). Automatic wire binder for straw presses and the like.
25 000 (United Kingdom). Cow milkers.
25 063 (United Kingdom). Grinding, crushing and cleaning grain.
25 275 (United Kingdom). Fermenting vats.
25 279 (United Kingdom). Hedge trimmers.
24 595 (United Kingdom). Cooling milk.
24 601 (United Kingdom). Separating apples.
24 614 (United Kingdom). Cracking nuts, seeds, etc.
24 771 (United Kingdom). Protecting orchards from frost.
24 816 (United Kingdom). Destroying weeds.
1 086 597 (United States). Hay loader.

RURAL ECONOMICS.

375 – **A Farm Management Survey of Three Representative Areas in Indi Illinois and Iowa.** — THOMSON, E. H. and DIXON, H. M. in *Bulletin of the U Department of Agriculture*, No. 41, pp. 42. Washington, January 14, 1914.

In the year 1911 the office of Farm Management of the Bureau of Pl Industry, United States Department of Agriculture, made a farm mana ment survey of 700 farms, the results of which are given and discusse the present paper. Three districts, one each in Indiana, Illinois and Io were selected for the farm management study; in choosing the areas effort was made to have as uniform farm conditions as possible in e region and representative of the agricultural conditions prevailing o a large area. The farms examined were 277 in the first State and 196 i 227 in the other two States respectively.

In Illinois and Indiana weather conditions were about the aver while in Iowa, owing to a drought in early summer, the results were ab

per cent below the average. The data were obtained by having trained stigators to visit the farmers personally.

The writers examined first the effect of the form of management, divided the farms into four groups: those operated by the owners, se worked by tenants, those owned by a farmer who rented additional l and those rented from two or more landlords, they then calculated incomes yielded by these various groups. (See Table I).

The labour income of farmers who operate their own farms is very lerate. For the amount invested the tenant's income is very much tter than that of the farm owner, though the absolute total income of latter is greater owing to the interest on the large capital. The evi- ce is unmistakeable that the man with small capital should rent ier than buy a farm. The third group, namely of owners who rent addi- al land, show a better labour income than that of owners; this is explain- y the fact that they utilize better their labour and their teams and re- e greater returns without any appreciable increase in investment. ulating the rate of interest on the capital invested in farms operated by owners at 3.5 per cent. instead of 5 per cent., the former being in fact the of interest obtained by the owner of rented farms, an average labour me of $870 to the operator, whether owner or tenant, may be expected. farms in the three States yield for an average size of 175 acres average labour income of $870 and an interest of 3.5 per cent. on the tal invested.

The labour income of farmers who run their own farms varies from w $500 to upwards of $2000. In order to show that the causes of e great differences depend mostly upon the varying activity of the ier and less upon the size of the farm and the amount of capital sted, the farms are grouped in Table II according to the labour me they yield, compared with the capital, area, expenses, and re- ts per acre.

From Table II it will be seen that the largest farms and the greatest tals are in the hands of those farmers who have obtained on the one d the best results, and on the other the worst.

If on the contrary the capitals of the tenants are compared with their ur income, it appears that almost without exception the tenant's me is in direct proportion to the sum he has invested, while the unt of capital has no connection with the rate of interest on the capital sted by the owner. (See Table III).

In order to study the influence of the size of the farm on the cost abour, the writers group the 700 farms according to size and calcu- for each the cost of labour, the number of draught horses, the crop per horse and the capital invested in machinery. (See Table IV).

On farms of 40 acres and less the cost of labour is over $10 per crop- . On all farms above 120 acres the cost is less than $6 per crop-acre. ge farms also utilize better their horse labour; on farms of 240 s one horse works two and one-half times as much land as on a 40 farm. The same laws which govern the use of farm labour apply

to machinery; thus, while in the smallest farms the value of the ma
nery is $5.4 per crop-acre, in the largest it ranges from $2.15 to $1.42.
labour in the larger farms, in spite of the greater area per unit of lab

TABLE I.

	Operated by owners					
	Indiana	Illinois	Iowa	Average	Indiana	Illin
Number of farms	123	73	77	total 273	83	
Average area . . . . . acres	105	253	176	178	128	2
Average capital . . . . . $	17 535	51 091	23 193	30 606	1 758	28
Receipts . . . . . »	1 876	5 042	2 308	3 076	1 335	22
Expenses . . . . . »	689	1 866	858	1 138	492	9
Farm income . . . . . »	1 187	3 176	1 450	1 938	843	12
Interest at 5 p. cent . . . . . »	877	2 554	1 159	1 530	88	1
Owner's labour income . . . . . »	310	622	291	408	755	11

TABLE II.

Labour income	Number of farms	Average size — acres	Average crop area — acres	Average capital — $
—$500 and more	26	267	199	46 582
—$499 to —$200	23	160	117	25 933
—$199 to $0	40	102	77	16 883
$ 1 to $ 200	53	120	95	19 753
$ 201 to $ 400	34	139	96	20 435
$ 401 to $ 600	23	161	118	27 986
$ 601 to $ 800	20	184	140	30 158
$ 801 to $1000	13	217	160	35 082
$1001 to $1500	19	201	169	32 658
$1501 to $2000	10	249	179	46 573
over $2000	12	330	140	55 625

zed with about the same intensity as in the small farms is shown ble V, in which the relation of the farm to the yield of the various is given.

TABLE I.

r tenants				Operated by owners renting additional land			
	Landlords						
Indiana	Illinois	Iowa	Average	Indiana	Illinois	Iowa	Average
83	71	93	total 247	56	36	37	total 129
128	202	187	172	—	—	—	105 + 78
18 423	36 479	20 728	25 210	11 321	32 382	17 829	20 510
1 002	1 538	1 014	1 185	1 780	4 279	2 228	2 762
351	213	354	306	742	1 599	887	1 076
651	1 325	660	879	1 038	2 680	1 341	1 686
3.53 %	3.64 %	3.19 %	3.5 %	566	1 619	891	1 025
—	—	—	—	472	1 061	450	665

TABLE II.

		Distribution per acre				
ock	Supplies	Receipts — $	Expenses — $	Farm income — $	Interest — $	Labour income — $
6.7	2.4	10.98	5.97	5.01	8.74	—3.73
7.4	2.3	12.02	5.92	6.10	8.16	— 2.06
7.7	2.6	12.94	5.53	7.41	8.30	—0.89
6.7	2.3	14.84	5.70	9.14	8.31	0.83
9.1	2.5	14.98	5.37	9.61	7.42	2.19
8.2	3.0	17.80	5.79	12.01	8.78	3.23
8.9	3.2	17.13	5.16	11.97	8.22	3.75
6.9	2.1	16.77	4.51	12.26	8.14	4.12
8.0	2.4	19.18	5.00	14.18	8.23	5.95
1.7	3.6	25.79	9.60	16.19	9.31	6.88
1.0	2.9	25.46	7.14	18.32	8.46	9.86

TABLE III.

	Tenant's capital $	Number of farms	Tenant's average capital $	Tenant's labour income $	Landlord's average capital $	Land inc on in ra per
Indiana	500 and less	5	324	328	9 492	
	501 to 1 000	13	750	312	9 940	
	1 001 to 1 500	18	1 263	506	12 829	
	1 501 to 2 000	19	1 726	765	17 679	
	2 001 to 3 000	18	2 381	1 051	22 130	
	3 001 to 4 000	8	3 324	1 217	34 904	
	4 001 to 6 000	2	4 770	2 322	54 088	
	Total or average	83	1 758	755	18 425	
Illinois	501 to 1 000	4	871	429	10 031	
	1 001 to 1 500	10	1 262	614	23 737	
	1 501 to 2 000	15	1 733	709	29 703	
	2 001 to 3 000	18	2 482	1 054	36 948	
	3 001 to 4 000	15	3 493	1 085	42 898	
	4 601 to 6 000	4	4 828	1 732	50 950	
	6 000 and over	5	9 011	4 117	70 750	
	Total or average	71	2 867	1 139	36 479	
Iowa	501 to 1 000	4	776	272	8 568	
	1 001 to 1 500	16	1 288	387	13 808	
	1 501 to 2 000	14	1 816	490	16 971	
	2 001 to 4 000	30	1 455	639	19 374	
	3 001 to 4 000	18	3 428	983	25 027	
	4 001 to 6 000	8	4 825	1 334	31 490	
	6 001 and over	3	8 303	1 641	50 412	
	Total or average	93	2 667	716	20 728	
Total or average for the three States.		247	2 419	850	24 482	

TABLE IV.

Area	Number of farms	Average Crop area * — acres	Cost of labour per crop-acre	Average number of work horses	Crop area per horse — acres	Value of machinery	
						Total per farm	per crop-acre
es united . . .	45	26.4	$ 10.08	2.8	9.4	$ 133	$ 5.04
80 acres . .	114	56.7	7.28	3.6	15.7	241	4.25
120 »	120	86.0	5.57	4.5	19.1	279	3.24
160 »	130	122.4	4.89	5.8	21.1	345	2.82
200 »	93	143.4	4.74	6.6	21.7	413	2.88
240 »	75	184.9	4.69	7.8	23.7	452	2.44
280 »	35	211.2	4.40	8.4	25.1	718	3.40
320 »	37	233.8	3.98	9.5	24.6	561	2.40
400 »	30	298.0	3.88	10.8	27.6	747	2.51
560 »	12	368.6	3.88	13.1	28.1	690	1.87
720 »	5	555.4	4.41	19.4	28.6	790	1.42
1250 »	4	612.0	5.29	19.0	32.2	1 313	2.15
r average . . .	700	142.8	4.63	—	—	383	2.69

* All tillable land except permanent pasture.

TABLE V.

e of farms — acres	Indiana				Illinois				Iowa			
	Number of farms	Yield per acre (bushels)			Number of farms	Yield per acre (bushels)			Number of farms	Yield per acre (bushels)		
		Maize	Oats	Wheat		Maize	Oats	Wheat		Maize	Oats	Wheat
less	92	50.2	44.4	19.0	12	60.4	43.0	16.0	26	33.2	32.0	—
50	75	52.9	47.5	19.2	42	52.3	37.5	15.2	73	36.3	33.0	—
20	39	52.8	47.0	19.4	70	52.4	39.7	15.8	71	37.9	33.9	—
over	—	—	—	—	20	55.6	40.5	17.8	—	—	—	—
al or average	206	52.1	46.6	19.3	144	53.3	39.3	16.5	170	37.0	33.5	—

n order to study the effect of the different type of farming on the s, both the farms run by their owners and those rented are divided crop farms, and live-stock farms, according to the prevalence of ing or raising live stock, and the labour income is recorded. (See VI).

TABLE VI.

Operated by:	State	Live stock farms					Crop farms			
		Number of farms	Area acres	Permanent pasture acres	Average capital $	Labour income $	Number of farms	Area acres	Permanent pasture acres	Average capital $
Owners	Indiana . . .	95	103.2	5.6	17 405	348	28	113.0	2.0	17 982
	Illinois . . .	32	284.2	66.3	58 487	1 588	41	229.4	24.4	45 319
	Iowa	67	181.2	40.1	23 775	329	10	140.9	17.1	19 196
	Total or average	194	189.5	37.3	33 222	755	79	161.1	14.5	27 332
Tenants	Indiana . . .	46	124	4	19 623	589	37	134	4	20 879
	Illinois	13	198	50	42 087	1 066	58	204	12	39 731
	Iowa	58	179	37	23 238	496	35	199	30	23 664
	Total or average	117	167	24	28 316	717	130	179	15.3	27 753

TABLE VII.

Operated by:	State	Live-stock farms				Crop farms		
		Number of farms	Yield per acre (bushels)			Number of farms	Yield per acre (bu	
			Maize	Oats	Wheat		Maize	Oats
Owners	Indiana. . . .	95	52	47	20	28	51	49
	Illinois	32	60	43	17	41	51	36
	Iowa	67	37	35	20	10	42	35
	Total or average	194	50	42	19	79	48	40
Tenants	Indiana . . .	46	53	45	19	37	51	46
	Illinois . . .	13	39	42	15	58	51	39
	Iowa	58	35	31	17	35	37	34
	Total or average	117	49	39.3	17	130	46	39.6

The live stock farms, both those operated by the owners and th rented, yield a higher income than the crop farms. This is due prima to two reasons: 1) That crop products, especially maize, fetch a hig price when fed to stock and converted into animal products than if sold

arket; 2) the live-stock man utilizes his labour throughout the which the crop farmers do not.

t is commonly supposed that the live-stock farmers make greater ; owing to much better crop yields. That such is not the case is ı by Table VII.

If the 247 farms operated by tenants, 58 were held on the cash-rent n and 189 on the share-rent system. A comparison of the income tenant and of the owner with both these forms of rental is shown in VIII.

TABLE VIII.

State	Cash- rent system					Share- rent system				
	Number of farms	Tenant's capital	Tenant's labour income	Landlord's capital	Returns on capital invested, per cent	Number of farms	Tenant's capital	Tenant's labour income	Landlord's capital	Returns on capital invested, per cent
		$	$	$			$	$	$	
. . . . .	14	2 272	864	14 968	3.42	69	1 654	733	19 126	3.55
. . . . .	18	3 118	1 440	28 771	2.50	54	2 788	1 044	38 906	3.89
. . . . .	27	2 942	689	19 114	2.37	66	2 555	727	21 388	3.49
or average	58	2 777	998	20 951	2.76	189	2 332	835	26 473	3.64

hose who leased their farms on a cash basis received a much lower then those on a share basis, as the risks are taken in the latter case tenant. From the tenant's point of view, in good years the cash rent ı is the most profitable, while in bad years the share-rent system er. In the State of Iowa, in the year for which the records were owing to unfavorable weather conditions the crops were about 20 nt. below normal, and the cash-rent tenants made less than those on re basis.

he writers lastly study the connetion between the age and educa- f the farmer and his profits. They find that, especially among te- the older farmers are the least successful. This is explained by the nat the younger and more capable tenants soon acquire sufficient to become owners, whilst the least capable are never able to save ı money to buy a farm; besides, landlords with good farms will nt their land to them, and they are compelled to take the least ole farms in the neighbourhood.

s for education, the investigations point to the fact that everywhere en with the best training made the largest incomes.

Silesian Grazing Farms. — WEITZ, G. in *Archiv für exakte Wirtschaftsforschung*, I Supplement, 257 pp. Jena, 1913.

he writer gives in 13 complete descriptions a review of the natural conomic conditions of the management and arrangement, as well

Grazing farm	Year	Area of farm acres	Extent of pasture acres	Kind of stock (1)	Average number of grazing days	Increase of weight per head of large stock (2) lbs.	Head of large stock per acre for 150 days grazing	Produce per acre £ d s	Expense per acre £ s d
XI (3)	1908	117.1	117.1	90 Y	117	2.82	0.352	2 5 1	3 2 8
»	1909	»	»	168 Y	142	2.23	0.737	4 8 1	3 7 11
»	1910	»	»	179 Y	119.6	2.28	1.676	4 2 6	3 7 2
XII (3)	1910	215.4	215.4	286 A 21 F	139	2.26	0.78	4 12 6	1 17 3
»	1911	»	»	341 A 18 F	107	2.04	0.51	2 15 6	1 15 4
II	1906	667	52	46 A 7 F	175	2.60	0.72	4 5 8	1 0 6
»	1907	»	52	40 A	164	1.90	0.65	3 5 6	1 7 7
»	1908	»	47	53 C	121	—	0.91	4 7 3	1 19 0
»	1909	»	47	50 C 3 F	144	—	1.08	6 7 0	1 18 2
»	1910	»	62	53 C	143	—	0.83	4 15 11	2 1 2
VII	1910	840	68	Varying:	140	1.68	0.62	4 7 9	2 4 10
VIII	1909	840	29.5	C, Y	113	2.10	1.41	7 11 10	2 3 2
»	1910	»	»	H, F	79	—	1.03	—	1 17 6
V	1908	844.6	29.5	Mostly Y,	140	3.57	0.97	6 14 9	3 2 5
»	1909	»	»	also	190	2.33	1.13	7 1 4	2 14 5
»	1910	»	»	F, C	197	1.37	1.62	5 19 9	2 10 7
»	1911	»	»	A, B	190	1.43	1.40	5 6 9	3 2 6
VI	1910	1188	43.2	62 Y 2 F	153.5	2.44	0.96	6 2 9	1 12 2
X	1909	1218	84.5	50 Y	143.6	2.42	0.30	1 18 4	1 11 9
»	1910	»	131	140 Y	146.2	1.44	0.45	1 15 0	2 6 0
XIII (3)	1910	61.0	61.0	84 Y 7 F	104	1.45	0.66	2 14 1	0 14 8
»	1911	»	»	83 Y 13 F	118	1.62	0.77	3 7 2	0 14 8

(1) Abbreviations in this column: Y = young cattle, A = cattle, F = foals, C = cows, H = horses.
(2) One head of large stock = 1000 lbs. live-weight.
(3) XI, XII and XIII are cooperative pastures.

Value of live stock £ s d	Total value per acre £ s d	Interest by net returns %	Cost of production: of 1 lb. live weight (Interest 4 % on capital invested) d	Cost of production: of 1 gal. of milk (Interest 4 % on capital invested) d	Value of farm per acre £ s d	Net returns of whole farm per acre £ s d	Gross returns of whole farm per acre £ s d	Interest on value of farm by net returns %
2 16 3	30 7 9	—	9	—	30 7 9	— 0 17 7	2 5 1	—
5 18 0	33 9 6	3.10	5	—	33 9 6	1 0 2	4 8 1	3.10
5 8 6	33 0 0	2.32	5 ¼	—	33 0 0	0 15 4	4 2 6	2.32
6 2 9	39 9 9	7.60	3	—	39 9 9	2 15 3	4 12 6	7.60
5 11 0	38 18 0	3.00	5	—	38 18 0	1 0 2	2 15 6	3.00
5 15 0	41 9 0	8.34	2 ⅜	—	43 13 0	1 5 4	5 17 10	3.47
5 3 9	40 17 9	5.13	4	—	»	1 4 6	7 9 0	2.80
7 6 3	43 0 3	6.07	—	4.57	»	1 4 1	8 9 7	2.76
8 13 0	44 7 0	10.46	—	2.92	»	1 10 4	5 17 10	3.47
6 12 9	42 6 9	6.94	—	4.27	»	1 4 6	7 9 0	2.80
4 19 0	32 1 9	7.29	3	4.71	35 14 3	1 15 2	5 12 4	4.92
11 6 6	52 5 0	10.30	2 ½	3.11	31 14 9	1 9 2	—	4.59
8 5 3	49 3 9	—	—	—	»	1 9 2	—	4.59
7 15 9	63 6 9	5.71	3 ½	—	62 5 6	4 1 2	8 19 10	6.52
9 1 9	64 12 9	6.72	3 ¼	—	63 17 6	3 2 3	9 5 0	4.88
13 1 9	68 12 9	5.16	3 ¾	—	63 17 6	4 3 3	8 18 4	6.52
11 4 6	66 15 6	3.31	4 ¾	—	»	—	—	—
7 13 6	72 18 6	6.47	3	—	40 6 0	0 7 5	6 9 7	0.93
2 7 6	35 12 6	0.93	6 ⅜	—	40 4 3	— 0 10 9	2 6 7	—
3 12 9	36 17 9	—	9	—	41 13 3	0 11 3	2 17 11	1.35
5 6 0	38 2 3	5.70	3 ½	—	38 2 3	1 19 5	2 14 1	5.70
6 4 3	39 0 3	7.23	3	—	39 0 3	2 12 6	3 7 2	7.23

as of the profitableness, of ten farms with grazing land and of three coop tive pastures, situated in different parts of Silesia; in these descriptions grazing industry in its installation, operation and profitableness, is spec considered.

Lastly, with the aid of numerous comparative tables, he discusses characters common to all these farms, and the points in which they d from each other. The most important results of this investigations given in the table on pages 528 and 529, for nine of the farms.

377 – **Two years' Results from the Cooperative Pasture at Coswig, in An (Germany).** — Butz *Landwirtschaftlich Umschau*, Year 6, No. 8, pp. 174 Magdeburg, February 20, 1914.

In the spring of 1911, the Coswig Cooperative Pasture Association w founded, and rented 28.64 acres of meadow land at 52*s* 4*d* per acre to as a grazing ground for young stock. The pasture was divided into th almost equal enclosures separated by wire fences and provided with a s and dinking trough. The expenses of laying out the pasture were as lows:

	£	*s*	*d*
1. Stamp duties for the contract	1	7	0
2. Statutes, advertisements, notification,	1	5	8
3. Loss on lease of pasture in 1911	14	1	3
4. Chemical fertilizers	22	14	5
5. Fencing materials	63	2	1
6. Shed	38	5	3
7. Drinking trough	6	4	6
8. Wages of labourers	23	2	5
9. Other wages	11	3	1
Total expenses	£ 181	5	8

The pasture was opened in May 1912 and 12 foals and 37 heifers w turned in; in 1913, 19 foals and 20 heifers were put out to grass. I foal's grazing day is reckoned as equal to 1 ¼ of a heifers' grazing day pasture provided 4752 heifer-grazing-days in 1912 and 6478 in 1913; in addition, in the first year a hay crop worth £12. 18*s*.

The outlay during the two years was as follows:

	1912			1913	
	£	*s*	*d*	£	*s*
1. Lease	74	19	5	74	19
2. Manures	17	10	7	6	8
3. Amortisation of capital (10 % on £ 1815.*s*)	18	2	6	18	2
4. Interest (4 %)	7	5	0	6	10
5. Wages of stockman	6	16	0	9	11
6. Labourer's wages	—	—	—	3	3
1. Sundries	1	12	10	4	11
Total expenditure	£ 126	6	4	£ 123	8
Less hay sold	12	18	0	—	—
	£ 113	8	4	£ 123	8
The grazing-day therefore cost	5.73 *d*			4.57 *d*	

The Cost of Milk Production in the Counties of Kent and Surrey. — EAD, G. H. and MACKINTOSH, J. in *South-Eastern Agricultural College, Wye, ond Report on the Cost of Food in the Production of Milk in the Counties of Kent Surrey*, 1912, pp. 1-28. London, 1913.

n enquiry into the cost of milk production which was instituted 12 by the South-Eastern Agricultural College, Wye, extended o farms in the counties of Kent and Surrey and a total of about 730

In calculating the cost of the milk production, only the value of the ed to the animals was considered, *i. e.* no allowance was made for lance, etc. The necessary data for the calculations — the cost of the nd the milk yields — were collected by an inspector who visited the once a month for this purpose. The bought food was reckoned at t price, and homegrown produce at the cost of production, while razing value was calculated according to the rent of the various ws.

he year was divided into three periods: winter (January-March), er (April-October) and autumn (November and December): the aver- ilk yield of each period was taken, and the cost of the daily food w and per gallon of milk was estimated.

he results are tabulated, and the writer discusses the differences ob- from one farm to another. A summary of the results is given in the ing table:

Period	Average daily milk yield per cow. gall.	Average cost of food per cow. per day	Cost of food per gallon of milk
January to March)	2.11	14.68 *d.*	6.96 *d.*
April to October)	2.24	5.70 *d.*	2.54 *d.*
November and December)	2.05	11.90 *d.*	5.80 *d.*
Annual average . . .	2.17	9.37 *d.*	4.32 *d.*

The Depopulation of the Country. — LAUR, E. in *Fühlings Landwirtschaftliche tung*, Year 63, Part. 1, pp. 1-22 and Part 2, pp. 53-63. Stuttgart, January 1 and 1914.

he writer makes use of the official census returns of about 20 dif- States for a general review of the changes in the rural population e countries during the period from 1880 to about 1900. He compares rease of population of towns (communities with from 2000 to 5000 tants) with the increase or decrease of the rural population, and cal- the change in the percentage of both in the total population. If the rs of inhabitants of the first census (which was taken in most States 0) be added together and compared with the sum of the second cen- hich, with one exception, refers to the year 1900 or a later year) the ng figures are obtained:

		In 1880	In 1900 and later	Incre
Total population		273 550 133	351 831 079	78 28
Town communities	Population	108 694 959	173 469 479	64 774
	Percentage	39.73	49.30	59.
Rural communities	Population	164 855 174	178 361 600	13 506
	Percentage	60.27	50.70	8.

The populations of town and country have both of them increased, but towns show an increase of 59.59 per cent. and the country of only 8.19 per The decrease of the percentage of rural population in the whole popula

TABLE I.

	Increase or decrease of			Percentage to total population			
				Town population		Rural popul	
	rural population	town population	total population	about 1880	about 1900	about 1880	abou
Servia	+ 1.98	+ 4.22	+ 2.236	11.4	15.0	88.6	8
Greece	+ 1.69	+ 3.36	+ 2.025	20.2	25.0	79.8	7
United States	+ 1.415	+ 5.98	+ 2.59	25.8	37.3	74.2	6
Rumania	+ 1.3075	+ 2.57	+ 1.495	14.8	18.8	85.2	8
Hungary	+ 0.955	+ 2.045	+ 1.08	14.6	16.7	85.4	8
Portugal	+ 0.586	+ 1.564	+ 0.859	29.1	32.8	70.9	6
Chile	+ 0.54	+ 3.13	+ 1.425	34.2	43.3	65.8	5
Denmark	+ 0.52	+ 3.26	+ 1.29	28.0	40.2	72.0	5
Switzerland	+ 0.445	+ 2.90	+ 0.855	16.6	22.4	83.4	7
Canada	+ 0.405	+ 4.33	+ 1.21	20.5	30.9	79.5	6
Belgium	+ 0.38	+ 2.31	+ 1.207	43.1	53.2	56.9	4
Norway	+ 0.376	+ 2.35	+ 0.80	21.5	29.4	78.5	7
Sweden	+ 0.236	+ 3.22	+ 0.686	15.1	24.4	84.9	7
Austria	+ 0.18	+ 2.62	+ 0.905	29.6	38.2	70.4	6
Germany	— 0.104	+ 3.44	+ 1.36	41.4	57.4	58.6	4
England	— 0.17	+ 1.99	+ 1.293	67.9	78.1	32.1	2
Scotland	— 0.27	+ 1.76	+ 0.985	62.0	69.8	38.0	3
France	— 0.304	+ 1.05	+ 0.21	34.8	42.1	65.2	5
Italy	— 0.425	+ 1.02	+ 0.79	84.2	87.5	15.8	1
Ireland	— 1.09	+ 0.56	— 0.69	24.0	31.0	76.0	6

; not always signify that the population of the country has absolutely inished. In reality in many States, especially in the so-called agricultural es, it has increased, but nowhere in the same measure as the town popula- . Only in some of the old civilized countries can a depopulation of the ıtry be spoken of, as only they show an absolute decrease of rural popula- . In the Table I the various States are arranged according to the yearly ease or decrease of the rural population in percentages of the popula- of the year 1880. For comparison, the increase and decrease of the town ılation and of the total population, as well as the variations of the per- age of town and country population, are given also.

All the States show an increase of town population, which in most cases excess of the natural increase of the population. In all the States the entage of the rural population in the whole population has diminished. The writer then examines, in those States for which data are available, changes in the agricultural population, in the working agricultural pop- ion, in the numbers of independent farmers and in those of farm loyees. The results of this investigation are given in Table II.

TABLE II.

State	Percentage of yearly increase or decrease			
	of total agricultural population	of working agricultural population	of independent farmers	of agricultural employees
ria	+ 1.60	—	— 1.30	+ 4.23
ia	+ 0.52	— 0.31	— 0.43	— 2.50
ark	+ 0.44	—	+ 2.74	— 0.69
ary	+ 0.39	+ 1.65	— 0.25	+ 0.62
um	+ 0.04	— 0.68	+ 0.23	— 1.22
erland	— 0.30	— 0.66	+ 0.05	— 0.73
ay	— 0.33	— 0.71	—	—
any	— 0.38	+ 0.75	+ 0.33	— 0.64
e	— 0.46	+ 0.41	+ 0.42	— 0.63
Britain and Ireland	—	— 0.65	— 0.45	— 0.81
d States	—	+ 2.97	+ 0.74	—

With the exception of Austria, the agricultural populations have everywhere increased less rapidly or have decreased more than the total agricultural population. The agricultural population evidently loses more abers by emigration to the towns and by change of occupation than the r callings in the country. In most of the old civilized countries there absolute decrease of the agricultural population, and only in the total cultural population, and only in the agricultural States is there a nota-

ble increase of the numbers of persons engaged in agriculture. Nevertheless the number of independent farmers has on the whole increased more or dimnished less than the total agricultural population. The emigration of t agricultural classes has thus been the cause of a diminution of the exing labour in individual farms, rather than of a decrease in the number independent farmers.

In concluding the writer treats of the causes of the emigration of t inhabitants of the country towards the towns, and of the means of retaini a numerous agricultural population. He considers the best means to be t prevalence of peasant farms and consequently maintainance, increase a improvement of the peasant classes; only the gradual conversion of the la into peasant farms will permanently solve the problem of the scarcity agricultural labour.

AGRICULTURAL INDUSTRIES.

380 – **Titration of Milk with Alcohol at Different Degrees of Concentration.**
LOHNIS F. in *Molkerei-Zeitung*. Year 28, No. 9 pp. 158-155. Hildesheim, January 30, 1

The alcohol test, as it is generally practised at present, that is to by mixing equal volumes of milk and 68 or 70 per cent alcohol (by volum is undoubtedly valuable for recognizing milk of abnormal quality, or s as, owing to its high content of bacteria, is barely utilizable. On other hand the normal milk of commerce does not always coagul with this test, even when its bacterial content is very high. Attempts h therefore been made to render the method more exact, and among ot suggestions that of doubling the quantity of alcohol has been made.

Recent experiments conducted by the writer with 90 per cent alco at once gave highly encouraging results, whilst tests with 70 per cent cohol at first failed completely. With milk rich in bacteria the wr had, it is true, satisfactory results even with 70 per cent alcohol. Eig per cent alcohol gave, in general, still better results. Two cc. milk at 15 to 20° C. (59 to 68° F.) were always taken for the titration t with the various alcohols. The number of cc. used is called by writer the "alcohol number" (Alkoholzahl) of the titrated milk. T number in brackets (90, 80, 70, etc.) indicates the concentration of alcohol used in percentages by volume (Tralles degrees).

The operation of titrating presents no difficulty. The final po is best found by pouring the 2 cc. of milk into a small beaker which is k somewhat slanting and shaking it gently over a black background. the alcohol is allowed to fall carefully drop by drop into the milk beginning of coagulation is recognized without difficulty, especialy wh the milk only forms a shallow layer at the bottom. Duplicate experime usually agree within 0.1 cc.; however, even differences of 0.2 or 0.3 wo not generally be of any great importance. In the first titration experime made by the writer 0.05 cc. was the greatest difference obtained in plicate tests.

ıite fresh milk of many cows shows consistently high alcohol numbers
ı lenth of time. For other cows, on the contrary, these numbers are
tently low. It is not rare, however, for the alcohol number to vary
lay to day. This seems to depend, partly at least, upon the weather,
ɔ increase and diminish with the temperature of the air. In winter
ɔohol numbers have always been found surprisingly low. A mixture of
rom several cows gives more stable alcohol numbers than that from
ɔne cow. The first milk obtained in milking usually gives alcohol
ers (90) higher by 0.5 to 1 cc. than that obtained towards the end.
theless, in 25 per cent. of the cases the reverse was observed. The
ing of the milk (scales, filter, cooler, etc.) most frequently has the
of slightly lowering the alcohol number. The alcohol numbers of
that had been kept some time increased or diminished according to
revalence of the acid or curdling bacteria or of those which decom-
protein.

)ut of 73 mixtures of milk in which the writer determined the alcohol
er, only four yielded divergent results. From the other results the
ing generalisation could be made:

Low	bacterial content:	Upwards	of 4 cc.	of alcohol	(80)
Average	» »	2 to	4 cc.	»	»
High	» »	less than	2 cc.	»	»
Very high	» »	»	» 2 cc.	»	(70)

f these numbers be compared with the values determined by the
ıl blue test (according to the method recommenced by Orla Jensen
hr. Barthel), it will be seen that there is no noticeable difference.
vriter prefers the alcohol test because it allows the low bacterial
nt to be recognised (less than 100 000 per cc.) and the keeping qua-
of the milk to be determined.

Where the milk tested was examined on the second day, the following
s were obtained:

	Alcohol number (80)	
	1st day	2st day
2 900 to 41 350 bacterias per cc . .	4.3 to 7.3	4.8 to 6.1
200 000 to 4 000 000 » » » . .	2.2 » 5.8	1,6 » 3.1
Above 4 000 000 » » » . .	1.0 » 1.8	less than 1.

The Bactericidal Properties of Milk at Low Temperatures. — De Rossi, No in *Rivista Scientifica del Latte*, Year 3, Part 6, pp. 90-91. Reggio-Emilia, December 1913.

Experiments were made with the object of ascertaining the behaviour of acteria in milk when the latter was placed in an ice-cellar immediately drawn, so that it was cooled nearly to freezing point. It was found the few germs originally contained in the milk diminished so rapidly gh the action of the low temperature that in a few days the milk was t sterile. When the milk before cooling contained many bacteria, their ers were considerably reduced by the cold. They began to diminish

within the first few hours, and continued to do so, reaching a minimum ge eraly by the sixth or seventh day, after which a new increase frequent set in. This fact can only be explained by the supposition that certa bacteria are not injured by the cold and that they can multiply at ve low temperatures.

In another series of experiments, the writer investigated the behavio of certain bacteria expressly added to the milk, especially germs of inf tious diseases which are believed to the spread by milk. It was found th by the action of cold, cholera and diphtheria bacilli introduced into the m in large quantities were completely destroyed in an average time of 24 hou but it required three or four days for typhus and tuberculosis bacilli to destroyed or even much weakened

It thus appears that milk at low temperatures not only impedes multiplication of bacteria, but diminishes their numbers, especially in case of germs injurious to health. But a long storage of milk at freezi point is not to be recommended, as the destruction of disease germs accompanied by the development of a number of other bacteria, wh though intrinsically harmless make the milk unfit for food.

382 **The Question of the Formation of Fat from Protein during the Ripen of Cheese.** — KONDO, KURO in *Biochemische Zeitschrift*, Vol. 59, Nos. 1 and 2, pp. 165. Berlin, January 22, 1914.

The writer prepared Cheddar cheese exactly according to the reci and estimated its fat content in the fresh condition, as well as dur and after ripening, in order to ascertain whether fat was built up fr protein during the maturing process. To this end, he divided each fr cheese into four equal portions. He at once determined the fat content one piece, and put the others aside to ripen, one in the air, one in an at osphere of carbonic acid, and the last in an atmosphere of hydrogen. addition, some of the cheeses were covered with paraffin and placed in open air to ripen. From time to time the writer took a sample from e cheese and tested its fat content by the Kumagawa-Suto soap thod (1). At the end of the experiment some fat determinations w also carried out by the ether extraction method for comparison.

The writer draws the following conclusions from the results of his periments :

1. When cheese ripens in the air, there is always a decrease in its fat c tent. The decrease is not equal in similarly made cheeses; it usually beg ten days after storing, and increases with time. The amount of the d inution of the fat does not appear to depend solely upon the time of ke ing, but very probably is also due to the physical pecularities of the che and to the temperature of the store-room.

2. The decrease in the fat content observed in cheese ripened in the is caused by the presence of a mould which grows upon the surface of

(1) A description of this method is to be fouud in Abderhalden's « Hendbuch biochemischen Arbeits-methoden » Vol. 5, pp. 477-488, publised by Messrs. I Sprin Berlin.

se; the fat consuming propensity of this fungus was first established Tsumagawa and Ohta. The growth of the fungus usually begins after lays of storing and increases so much with time, that the whole sur- of the cheese is eventually covered with whitish fungus hyphae. The ease in the fat content entirely corresponds to the growth of the fungus.

3. In the case of paraffined cheeses exposed to the air the decreases le fat content is almost as great as in unparaffined ones. This proves the oxygen of the air finds its way through the thin layer of wax and es the surface of the cheeses, thus permitting the germination of fungus spores. If the cheeses are, however, dipped repeatedly in the ffin bath from the beginning of the experiment, the fungus makes little growth during the storage, and the decrease in fat is much less. writer did not, however succeed in entirely checking the growth of ungus by treating the cheese with paraffin.

4. The ripening of the cheese and the diminution in its fat content wo entirely separate processes; therefore the cheese need not neces- y always become poorer in fat through ripening. This is proved by act that there is no loss of fat when the cheese is ripened in the absence mospheric oxygen, under which condition it ripens as satisfactorily the air. Further, it was found that the non precipitating nitrogen ys increased with the time of keeping and at the cost of the preci- ing nitrogen; this occurred to the same extent whether the cheeses kept in air, or in atmospheres of carbonic acid or hydrogen.

5. Aerobic bacteria are thus indispensable to the ripening of cheese, ugh it has not yet been ascertained whether this process depends upon robic microorganisms, or whether it is not solely due to the presence in cheese of pre-existing ferments. The writer inclines to the latter

6. The experiments on the lipoid content of the cheese which were car- out with the alcohol-ether extract method on the one hand, and with soap method on the other, showed that the amount obtained by the ter was throughout from 2 to 3 per cent. larger in the case of ripe cheese in the fresh product, while with the latter method, the corresponding es were decreased from 2 to 3 per cent. The increase in the ether-extract le cheese-ripening was, however, far less than the writer had expected.

7. It can thus be stated that under no circumstances does an increa- the fat content take place during te ripening of cheese, and conse- ntly there can be no formation of fat from protein. The amount of n cheese ripened in the air continually decreases, owing to the growth ould, of while it remains unchanged if the ripening process takes place le absence of oxygen.

The Baking Qualities of Flour as influenced by Certain Chemical Substances, Milling By-products and Germination of the Wheat. — WILLARD, J. T. nd SWANSON, C. O. in *Kansas State College of Agriculture, Bulletin* No. 190, pp. 237-85 + plates I-IX. Manhattan, Kansas, October 1913.

The dependence of the physical properties of gluten on the presence of ain substances in small amounts suggested the following experiments

TABLE I.

Total time in minutes for rising as affected by different substances.

Substance	Minimum quantity in grams	Number of times minimum quantity				
		0	1	2	4	8
Peptones	0.4	180	172	166	158	153
Glycocoll. $CH_2(NH_2)COOH$	0.1	172	164	160	166	166
Leucin $(CH_3)_2CH\,CH_2\,CH(NH_2)\,COOH$	0.025	170	166	157	167	166
Aspartic acid $COCH.\,CH_2.\,CH(NH_2)\,COOH$	0.1	160	151	142	125	130
Asparagin $CONH_2\,CH_2\,CH(NH_2)\,COOH + H_2O$	0.1	176	161	149	149	140
Ammonium acetate $CH_3.\,COON\,H_4$	0.1	174	161	150	144	136
Ammonium tartrate $NH_4\,OOC.\,CHOH.\,CHOH.\,COONH_4$	0.1	169	159	149	143	150
Ammonium chloride $NH_4\,Cl$	0.025	157	155	155	148	142
Ammonium phosphate $(NH_4)_2\,HPO_4$	0.1	162	159	152	150	150
Sodium phosphate $Na_2\,HPO_4 + 12H_2O$	0.4	170	166	155	154	160
Sodium bicarbonate $NaHCo_3$	0.1	176	175	170	186	180
Sodium formate $H.\,COONa + H_2O$	0.1	157	151	157	165	140
Potassium nitrate KNO_3	0.1	161	154	156	152	160
Bran extract, cold extraction	2.5 (1)	166	156	148	145	120
Bran extract, cold extraction filtered	2.5 (1)	161	152	145	143	130
Bran extract, hot extraction	2.5 (1)	167	164	147	144	150
Wheat scourings, extract I	2.5 (1)	135	127	118	110	110
Wheat scourings, extract II	2.5 (1)	176	171	161	157	150
Flour from germinated wheat	25.0	162	140	118	113	130
Flour from germinated wheat	9.0	165	160	152	148	140
Cold bran extract from germinated wheat	2.5 (1)	170	163	156	148	150
Boiled bran extract from germinated wheat	2.5 (1)	127	128	135	131	120
Cold extract from shorts of germinated wheat	2.5 (1)	153	133	125	121	110

(1) Weights of material extracted.

on the effect of different quantities of the products of protein m bolism, inorganic salts, and extract of bran and shorts, on the ba qualities of flour. It is probable that hydrolysis of the proteins takes during the growth of yeast in the flour and that the products thus liber play an important part in the growth of the yeast and affect the phy properties of the gluten.

The yeast used in these experiments was obtained fresh from a baker and stored in a dry refrigerator. It was thoroughly mixed and wei out into glass-stoppered bottles in 10 gm. portions. Unbleached flour heated to a temperature of 35° C. and used in 300 gram portions. The amount of water was used in each test, *viz.* 165 cc., and the required quai

TABLE II.

Rise in the oven during baking as affected by different substances.

Substance added	Minimum quantity grams	Number of times minimum quantity					
		0	1	2	4	8	16
ics	0.4	4.4	4.8	4.6	3.9	3.9	4.2
coll	0.1	4.3	3.9	2.5	3.1	3.5	1.8
n	0.025	4.5	4.5	4.0	3.5	5.1	4.5
tic acid	0.1	5.5	5.3	4.9	4.9	5.5	5.5
agin	0.1	5.1	5.2	5.1	4.8	3.8	4.6
nium acetate	0.1	4.4	5.2	5.4	5.5	5.5	5.3
nium tartrate	0.1	4.7	5.0	4.8	5.2	5.6	4.4
nium chloride	0.025	3.3	4.2	3.8	5.3	6.1	6.1
nium phosphate	0.1	5.0	5.4	5.5	5.4	5.4	5.4	
n phosphate	0.4	4.4	4.5	4.7	4.2	4.5	4.6
n bicarbonate	0.1	4.0	4.5	4.0	2.6	2.5	2.0
n formate	0.1	5.5	5.5	5.3	5.1	5.5	5.5
ium nitrate	0.1	5.0	4.8	4.1	4.5	5.1	5.1
extract, cold extraction	2.5 [1]	4.9	4.9	4.7	5.3	5.4	5.6
extract, cold extraction filtered	2.5 [2]	5.0	5.2	5.4	5.4	5.6	5.7
extract, hot extraction	2.5 [3]	4.2	4.5	4.8	5.4	5.6	5.9
scourings, extract I	2.5 [4]	5.4	5.7	5.4	5.1	5.1	5.1
scourings, extract II	2.5 [5]	3.8	4.0	3.1	3.9	3.5	2.9
from germinated wheat	25.0	4.9	5.4	5.6	4.0	4.2	1.1
from germinated wheat	9.0	4.3	4.5	4.7	4.5	3.7	2.7
ran extract from germinated wheat	2.5 [1]	4.3	3.4	4.0	5.0	4.3	4.5
bran extract from germinated wheat	2.5 [2]	3.6	5.6	5.1	5.5	5.4	4.8
xtract from the shorts of germinated wheat	2.5 [3]	5.2	5.7	5.6	5.6	5.9	5.8

[1] Weights of material extracted.

e substance added with 15 grams of sugar and dissolved in a beaker ° C. The yeast was mixed with this solution and allowed to ferment) minutes at 35° C. before mixing with the flour. The dough was made lacing 200 grams of the warmed flour and the yeast liquor in a Kœlner ler and working it at full speed for 30 minutes, when the remainder of our was added and worked into the dough with a spatula for 5 minutes. is then tested by placing it in a cylinder 30 cm. high and of such a eter that 1 cm. in height corresponds to 100 cc. All the doughs had a ne of about 550 cc. and were allowed to rise to a volume of 1650. The was noted and the dough worked lightly in the hands and allowed to gain as far as possible. It was worked in the hands again and placed in

TABLE III.

Volume of loaf as affected by different substances, in cubic centimeters

Substances added	Minimum quantity added	Number of times minimum quantity added				
		0	1	2	4	8
Peptones	0.4	1380	1390	1370	1280	1300
Glycocoll	0.1	1380	1330	1270	1240	1180
Leucin	0.025	1380	1340	1280	1270	1360
Aspartic acid	0.1	1460	1470	1460	1420	1500
Asparagin	0.1	1440	1410	1380	1380	1300
Ammonium acetate	0.1	1440	1490	1490	1500	1520
Ammonium tartrate	0.1	1460	1470	1450	1520	1550
Ammonium chloride	0.025	1300	1420	1260	1520	1600
Ammonium phosphate	0.1	1470	1470	1470	1470	1440
Sodium phosphate	0.4	1430	1450	1460	1400	1410
Sodium bicarbonate	0.1	1330	1370	1350	1210	1170
Sodium formate	0.1	1550	1530	1500	1470	1550
Potassium nitrate	0.1	1500	1480	1440	1500	1520
Bran extract, cold extraction	2.5 (1)	1480	1490	1410	1510	1520
Bran extract, cold extraction filtered	2.5 (1)	1470	1500	1520	1550	1550
Bran extract, hot extraction	2.5 (1)	1400	1420	1440	1520	1550
Wheat scourings, extract I	2.5 (1)	1450	1480	1500	1520	1540
Wheat scourings, extract II	2.5 (1)	1360	1460	1280	1360	1260
Flour from germinated wheat	25.0	—	—	—	—	—
Flour from germinated wheat	9.0	1400	—	—	—	—
Cold bran extract from germinated wheat	2.5 (1)	1350	1290	1310	1360	1320
Boiled bran extract from germinated wheat	2.5 (1)	1360	1460	1400	1500	1460
Cold extract from the shorts of germinated wheat	2.5 (1)	1460	1530	1520	1520	1530

(1) Weights of material extracted.

weighed baking-cans so constructed that, when placed in the oven dough presses against a circular disc attached to a vertical shaft regu so as to ensure a uniform rise in all the samples before baking. The l were ther baked 35 minutes at 240° C. and the rise during this time measured on the shaft. After cooling 30 minutes they were weighed an volume determined by displacement of flax-seed

The results are tabutated in tables I, II and III. They show tha

1) Peptones and amino acids have an adverse effect on the phy qualities of the gluten. The dough was sticky and the texture of th

inferior to that of the control. Asparagin appears to stimulate the y of the yeast, thus shortening the time of rising.

2) Inorganic salts in general improve the quality of the dough and this effect being most marked in the case of ammonium chloride. This is very effective in such small quantities as $^1/_{300}$ to $^1/_{75}$ ounce per loaf, ponding to the medicinal dose of this salt. Sodium bicarbonate has rious effect probably owing to its alkaline nature.

3) Extract of bran appears to stimulate the activity of the yeast, thus ning the period of rising and increasing the rise during baking and f volume. It had, however, an injurious effect on the texture of the The hot extract had less effect in shortening the time of rising, thus ting that the stimulating effects of the cold extract on the yeast are enzymes.

4) Ordinary bran mixed with flour gave loaves of poorer texture ose made with extracted bran and extract of bran used separately.

5) Extract of scourings (*i. e.* wheat dust and offal) shortened the period entation and produced a sticky dough, thus resulting in a loaf of r texture. These effects were more pronounced with the products minated wheat. The dough was exceedingly difficult to handle and f from the flour of germinated wheat fell to pieces.

nclusions :

1. — The results obtained with ammonium chloride suggest further ments to study its effect on the growth of yeast and to determine antity remaining in the bread.

2. — The constituents of the bran extract affecting the growth of yeast e qualities of the gluten may have important chemical effects, which count for the beneficial effects of Graham bread. Further experiments ggested to determine the nature of these constituents and their on nutrition.

3. — It would appear that Graham bread might be improved by soak- bran separately before mixing with the flour.

4. — The effect of extract of scourings appears to be due to the same s the effect of flour from germinated wheat, *i. e.* the amino-decompo- products of the wheat proteins.

5. — The methods of handling and storing grain and flour would appear apable of affecting its baking qualities to a considerable extent.

PLANT DISEASES

GENERAL INFORMATION.

384 – **The Recommendations of the International Phytopathological Confe**
(Rome, February 24-March 4, 1914).

On February 24, 1914, a conference was held in Rome at the Inte tional Institute of Agriculture for the purpose of securing internati cooperation in the control of plant diseases. The Conference, which held under the auspices of the Institute, was summoned by the Fr Government in conjunction with the Italian Government; the follo States took part in it and sent their delegates:

ALGERIA:

LOUIS DOP, Vice-President of the International Institute.

R. MAIRE, Algiers.

AUSTRIA:

KARL PORTELE, Professor and Aulic Councillor, Ministry of Agricult

Chev. V. DE POZZI, Government Councillor, Delegate to the Per nent Committee of the International Institute.

BELGIUM:

T. VERNIEUWE, Director of the Horticultural Office, Ministry of A culture.

O. BOLLE, Delegate to the Permanent Committee of the Internati Institute.

P. MARCHAL, Botanist at the State Agricultural Institute, Gemb

CANADA:

H. G. GUSSOW, Dominion Botanist.

CHILE:

S. ALDUNATE, Minister Plenipotentiary, Delegate to the Perma Committee of the International Institute.

CHINA:

SIU-KIU, Delegate to the Permanent Committee of the Internati Institute.

COSTA RICA :
. MONTEALEGRE, Minister Plenipotentiary, Delegate to the Permanent ittee of the International Institute.

DENMARK :
.. DE OLDENBURG, Chargé d'affaires, Delegate to the Permanent ittee of the International Institute.
r. KÖLPIN RAVN, Royal Danish Veterinary and Agricultural College.

DOMINICA :
ount PASINI-FRASSONI.

FRANCE :
. DEVELLE, Senator, Ex-Minister of Foreign Affairs and of Agriculture.
. DE BILLY, Minister Plenipotentiary, Councillor at the French ssy.
OUIS-DOP, Vice-President of the International Institute.
. MANGIN, Membre de l'Institut, Natural History Museum, Paris.
. L. BOUVIER, Membre de l'Institut, Natural History Museum, Paris.
. MARCHAL, Membre de l'Institut, Director of the Entomological m, Paris.
. SCHRIBAUX, Director of the Seed Testing Station, Paris.
. FOEX, Sub-Director of the Station for Plant Pathology, Paris.

GERMANY :
r. T. MUELLER, Privy Councillor, Delegate to the Permanent Com- e of the International Institute.
r. JUNG, Privy Councillor, Member of the Council of the Imperial ical Institute, Dahlem.
r. BEHRENS, Privy Councillor, Director of the Imperial Biological ute, Dahlem.

GREAT BRITAIN :
t.-Col. Sir DAVID PRAIN, Director of the Royal Botanic Gardens, Kew.
ir JAMES WILSON, K. C. S. I., Delegate to the Permanent Committee e International Institute.
. G. L. ROGERS, Director of the Horticultural Section, Board of ulture.

GREECE :
o. A. ISAAKIDES.

GUATEMALA :
. MONTEFIORE, Consul General, Delegate to the Permanent Com- e of the International Institute.

HUNGARY :
. DE MIKLÓS, Secretary of State, Member of House of Magnates, De e to the Permanent Committee of the International Institute.
r. G. DE ISTVÁNFFY, Director of the Viticultural Institute, Budapest.

BRITISH INDIA :
H. MAXWELL LEFROY, Imperial College of Science and Technology, lon.

IRELAND :

G. H. PETHYBRIDGE, Economic Botanist, Department of Agricult and Technical Instruction, Ireland.

ITALY :

Marquis R. CAPPELLI, Vice-President of the Chamber of Deput President of the International Institute.

Prof. BATTISTA GRASSI, Senator, Membro dell'Academia dei Lin

ORESTE SAVINA, Consul General, Ministry of Foreign Affairs.

Prof. MICHELE CARLUCCI, Chief Inspector of viticulture and pl diseases.

Prof. ANTONIO BERLESE, Director of the Station for Agricultural tomology, Florence.

Prof. G. CUBONI, Director of the Station for Plant Pathology, R

JAPAN :

M. N. ITO, Attaché at the Embassy, Delegate to the Permanent C mittee of the International Institute.

LUXEMBURG :

T. VERNIEUWE, Director of the Horticultural Office, Ministry of culture, Brussels.

O. BOLLE, Delegate to the Permanent Committee of the Internati Institute.

P. MARCHAL, Agricultural Institute, Gembloux.

MONACO :

Dr. PAUL REGNARD, Member of the Academy of Medicine, Direct the " Institut Agronomique " and of the Oceanographical Institute, I

MAROCCO :

LOUIS-DOP, Vice-President of the International Institute.

NETHERLANDS :

Baron W. B. R. DE WELDEREN RENGERS, Minister Plenipotent Delegate to the Permanent Committee of the International Institute.

P. van HOEK, Director of Agriculture.

Prof. T. RITZEMA BOS, Director of the Phytopathological Insti Wageningen.

OTTOMAN EMPIRE :

Dr. MEHMED DJEMIL BEY, Delegate to the Permanent Comm of the International Institute.

ROUMANIA :

C. PENNESCO, Councillor at the Legation, Delegate to the Perm Committee of the International Institute.

V. BARANGA, Secretary of the Ministry of Agriculture and Estat

G. ARION, Entomologist, Ministry of Agriculture and Estates.

RUSSIA :

His Excell. G. ZABIELLO, Consul General, Delegate to the Perm Committee of the International Institute.

A. DE JACZEWSKI, Lord Chamberlain to H. M. the Emperor, Director e Mycological and Phytopathological Bureau of the Scientific Com- e of the Office for Agricultural Organisation and Agriculture.

SERVIA :

L. MICHAÏLOVITCH, Chargé d'Affaires.

SPAIN :

E. R. DE CELIS, Delegate to the Permanent Committee of the Interna- l Institute.

SWEDEN :

Baron C. N. D. DE BILDT, Minister Plenipotentiary, Delegate to the national Institute of Agriculture.

Prof. J. ERIKSSON, Chief of the Botanical Section, Central Institute gricultural Experiments, Stockholm.

SWITZERLAND :

J. B. PIODA, Minister Plenipotentiary, Delegate to the Permanent nittee of the International Institute.

Prof. MÜLLER-THURGAU, Director of the Federal Experimental on for Arboriculture, Viticulture and Horticulture, Wadensweil.

Dr. FAES, Director of the Phytopathological Section of the Viticul- Experimental Station, Lausanne.

TUNIS :

LOUIS-DOP, Vice-President of the International Institute.

A series of meetings was held from February 24 to March 4, 1914, at h the delegates expressed the general desire of their respective Govern- s to abide by previous decisions of the General Assemblies of the national Institute of Agriculture, and to continue and further mea- already agreed upon at previous agricultural congresses. The Con- ce, without in any way interfering with the measures adopted under ng international agreements, drew up the following draft Convention dated March 4, 1914, and to be submitted to the various Govern- s for approbation, and signed by plenipotentiaries nominated for the se if approved.

Art. 1. — The contracting States undertake to adopt the legislative administrative measures necessary to ensure common and effective n against the introduction and spread of plant enemies.

These measures shall especially deal with : 1) the efficient supervi- f nurseries, gardens, green-houses, and other establishments supplying arket with live plants (young plants, cuttings, scions, flower-bulbs ut blossoms) ; 2) the reporting of the appearance of plant diseases f injurious animals, and the specification of infected districts ; 3) the s of checking and preventing plant diseases ; 4) the regulation of the port and the packing of plants and of the parts of plants mentioned ; 5) the measures to be taken in case of infringement of regulations.

Art. 2. — There shall be created in each State adhering to the present

Convention an official Phytopathological Service for the purpos carrying out these measures.

The official Phytopathological Service will include as a minim 1) the creation of one or more research stations for scientific and tech investigations; 2) the organisation of the efficient supervision of cultivat 3) the inspection of consignments; 4) the issue of phytopatholo certificates.

Art. 3 — The measures mentioned in paragraphs 2, 3 and 4 of a shall already have been carried out at the time of the ratification o present convention, or of adherence to it. All the other measure arts. 1 and 2 shall be carried out in each State within two years from date of the ratification of the present Convention, or of adherence t

Art. 4. — The provisions of the present Convention shall not appl vines, grain and seeds, edible tubers, bulbs, rhizomes and roots, fruits vegetables, or to any crops grown on a large scale.

Art. 5 — With a view to the protection of the contracting States the introduction and spread of plant enemies, these States unde to allow the importation of live plants (young plants, cuttings, scions wer-bulbs and cut flowers) only if they are accompanied by a phytop logical certificate issued by competent officials of the exporting countr

Art. 6. — The importation of the plants mentioned in the prec article shall take place only through specified customs offices, of wh list will be drawn up by the importing country and sent to the expo country.

Art. 7. — Each country reserves the right of inspecting all living pl or parts of plants, imported.

In the event of the consigment being infected, contrary to the dec tion on the certificate, the importing country shall at once inform Government of the exporting country, which will take the measures vided for by its own regulations.

Products recognized as infected shall be returned to their ori starting point at the expense of the defaulting party, or burnt shoul consignee desire it; in the latter case, an official report shall be forwa to the Government of the exporting country.

Art. 8. — The certificates shall conform to the model annexed t Convention, and shall be drawn up in two languages: French, and language of the exporting country.

Art. 9 — Live plants imported for scientific purposes are not subj these restrictions; they may be admitted, even without certificat condition that they are directed to a scientific institution duly auth by the Government of the importing country, and that the conditions u which they are sent afford every guarantee against the dispersion o parasites. Contiguous States may make mutual arrangements to facil exchanges of plants in the frontier zones.

Art. 10. — The different contracting States are invited to send t of the plant enemies against which they desire to protect themselves, b

national Institute of Agriculture at Rome, at the time of the ratification e present Convention or of their adherence to it. The list will be hort as possible and will be entered on their respective certi- es. These lists will be drawn up according to the following principles:

A. Common enemies of plants, which have long since spread to nearly ountries, will be excluded from the lists; as well as parasites whose l host-plants do not exist in the importing countries.

B. In specifying the plant enemies which are to appear on the lists, the e will be limited to:

1. Those of an epidemic character.

2. Parasites which are destructive, or at least very harmful to crops.

3. Those which are easily propagated by live plants, or by living s of plants.

Art. 11. — The creation of an official Service of Phytopathology shall otified by each contracting State to the International Institute of Agri- re at Rome.

Art. 12. — From the date of the signature of the present Convention, contracting States shall recognise the International Institute of culture at Rome as the official international centre for all questions ing to plant enemies.

The Institute shall collect statistical data, together with informa- of an administrative, scientific, or practical nature dealing with plant diseases and plant enemies. These data will be obtained documents which shall be furnished to it as promptly as possible by fficial Phytopathological departments, and by the Phytopathological earch Stations authorised and controlled by the Governments.

Art. 13. — The International Institute of Agriculture shall publish, at once a month, the administrative, scientific and practical information smitted to it.

Art. 14. — Every proposal made by a contracting State, for the lification or amplification of the present Convention, shall be commu- ted by that State to the Institute, and referred by it to a meeting pecial delegates of the contracting parties, which shall be called ther on the occasion of a General Assembly of the Institute.

The General Assembly will subsequently submit the proposals elaborated these special delegates for approbation by the States adhering to the ent Convention.

Art. 15. — In case of any disagreement between two, or more, of the tracting States as to the interpretation of the clauses of this Convention, n cases of difficulties of a practical nature with regard to its application, parties in question undertake to submit their differences to discussion by ecial mixed Committee formed by members of their Phythopathological artments, with a view to the proposal of measures calculated to adjust differences.

Art. 16. — The States bound by the present Convention shall not treat -contracting Countries more favourably than contracting States.

Art. 17. — The present Convention shall be signed and ratified as s as possible, and the ratifications shall be deposited with the Italian Gove ment as soon as at least three of the contracting States are in a posi to do so.

Each ratification shall be communicated by the Italian Governm to the other contracting States, and also to the International Institut Agriculture.

Art. 18. — States which have not signed the present engagem shall be allowed to adhere to it on request.

At the request of the States upon which they are dependent, Colo shall be permitted to adhere on the same conditions as independent Sta

Art. 19. — Adherence shall be notified through diplomatic channel the Italian Government, and by it to the contracting Governments also to the International Institute of Agriculture.

Art. 20. — The ratification, or adherence, shall be accompanied a formal declaration to the effect that the State possesses at least staff mentioned in paragraphs 2, 3 and 4 of art. 2.

The present Convention will come into force, for the three States at least which shall have ratified it, after a lapse of three mon from the date of ratification; for the other States, after a lapse of months from the respective date of deposition with the Italian Governm of their ratification, or adherence.

Art. 21. — Should it happen that one of the contracting States wis to withdraw from the present Convention either with regard to whole territory, or only with regard to the whole or a portion of Colonies, its wirthdrawal shall be notified to the Italian Governme which shall immediately send a copy of the notification to all the ot States, informing them of the date on which it received the communicati

The withdrawal will apply only to the notifying State or to Colonies mentioned in the notification, and this only after one year elapsed from the time the notification was received by the Ital Government.

As a guarantee, the delegates attending the final meeting signed formal record of these recommendations, which was dated Ro 4th March, 1914. The original document is deposited at the Ital Ministry for Foreign Affairs. Certified copies will be sent to all the Sta represented at the Conference.

APPENDIX TO THE FINAL
ENACTMENT OF THE CONFERENCE.

International Phylloxera Convention of Berne
and International Phytopathological Convention of Rome

CERTIFICATE
FOR THE DESPATCH OF HORTICULTURAL PLANTS. *

NAME OF COUNTRY OF EXPORT

I. — Declaration of Consigner.

The under-signed (1) . . . . . .
y declares :
1. That the plants (2) . . . . . .
. . . . . .
ined in (3) . . . . . .packages, marked . . . . (4) . . . . . .
. .addressed to (5) . . . . . .
. . . . . .have been produced on his establishment, or on establishments subjected to inspection by the Phytopathological tment.
2. That this consignment contains no vines.
3. That the plants are packed (7) . . . . . .their ball of soil.
(8) . . . . . the . . . .day of 191

ablishments inscribed on the own up according to art. 9 the Phylloxera Convention ne, under the No. . . . . (10)

Consigned by . . . . . (9)

Name, firm, profession and address. — (2) Kind and quantity of plants. — nber of packages. — (4) Mark and number. — (5) Full address, name and pro- of consignee. — (6) Name of country of destination. — (7) State whether the are packed *with* or *without* their ball of soil. — (8) Place from which sent. — nature of consigner. — (10) Give the number entered on general list.
Each statement on the certificate must be accompanied by a translation in French.

II. — Certificate of the Administrative Authority *.

The administrative authority (1) certifies :

A. That the above consignment of plants comes from a holding th at least 20 metres distant from any vine stock, or that is separated from stock by an obstacle to roots which is considered to be sufficient by competent authority.

B. That the holding itself contains no vines.

C. That no depôt for this plant exists on the holding.

D. That the holding has never been a centre of phylloxera infe

E. That if the holding has contained phylloxerous vines at any these have been radically removed, and that suitable means of eradic the disease and repeated inspections for three consecutive years, ensured the complete destruction of the insect and of the roots.

Date . . . . . .

Seal of competent local authority

. . . . . .

(signature)

(1) Burgomeister, mayor, or other competent local authority.

* This certificate should not be filled in where the holding figures on the lis lished in accordance with art. 9 § 6 of the International Phylloxera Convention o

III. — Certificate of Phytopathological Inspection.

The undersigned Inspector of the Phytopathological Departme

, ...

certifies that the consignment referred to in the declaration of the con

(2) . . . . . .consists

produce of crops grown at . . . . . .

The results of inspection have shown that the

(3) { home-grown produce / transported produce }

is in a satisfactory state of health and is free from the following sites (4) . . . . . .

. . . . . .

Date . . . . . .

Seal

(Signature)

(1) Christian name, surname, official position and address of the inspec (2) Christian name and surname of the consigner. — (3) Strike out, as requir irrelevant words.. — (4) Add the list of plant parasites enumerated in the offi of the importing country which might be present in the consignment.

- A Law Placing at the Disposal of the Minister of Agriculture of France from the Budget of 1913 the Sum of 750 000 frs. for the Control of Voles. — *Journal Officiel de la République Française*, Year 46, No. 10, p. 314. Paris, January 11, 1914.

On January 7, 1914, the President of the Republic French promulgated the following law.

The sole article. — In addition to the sums allotted to the Minister of Agriculture from the Budget of 1913 by the finance law of July 30, 1913, and by special laws, an extraordinary credit of 750 000 fr. (nearly £ 30 000) is placed at his disposal; this sum will be entered under a special heading bearing the number 28 *bis* and entitled as follows: "Grants to Communes, Syndicates and Agricultural Associations for the Destruction of Voles. Cost of Organisation of Control Measures".

This sum will be provided by the general funds of the financial year 1913.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

- The Importance to Vegetation of the Dissipator (Lattice-work) Chimney. — WINKELMANN, H. in *Die Naturwissenschaften*, Year II, Part 10, pp. 225-229 + 2 plates. Berlin, March 6, 1911.

The writer describes a new method of preventing the bad effect upon vegetation which is exerted by the smoke gases from factories. This method consists in the adoption of the so-called lattice-work or dissipator chimney. The latter differs from an ordinary chimney in the fact that the smoke leaves the shaft already mixed with air and with a more or less strong rotatory motion, and not in a compact column; this permits of the more rapid division of the smoke and of its quicker diffusion in the atmosphere. No chemical change takes place, however, in the injurious gases which are given off.

BACTERIAL AND FUNGOID DISEASES.

- Fungus Diseases of Wheat, Barley and Citrus Fruits in Egypt. — ROLLAND, B. G. C. in *The Agricultural Journal of Egypt*, Vol. III, Part I, pp. 28-30, plate I. Cairo, 1913.

The smut diseases, known in Arabic as "el khamira", are of frequent occurrence throughout Egypt. Wheat is attacked chiefly by *Ustilago Tritici*, while barley is attacked by both *U. nuda* and *U. Hordei*.

The writer also describes a disease of citrus fruits, especially oranges, known as wither-tip and caused by *Colletotritichum gloeosporioides* Penz. He gives an account of the means by which these fungi are controlled.

388 – **Experiments on the Control of *Pleospora trichostoma* on Barley.** — Müller, H. C. and Molz, E. in *Deutsche Landwirtschaftliche Presse*, Year XXXI No. 17, pp. 205 and 206. Berlin, February 1914.

As the control of the "brown streak" of barley leaves (caused by *Pleospora trichostoma=Helminthosporium gramineum*) is generally combined with the control of the two smuts (*Ustilago Hordei* and *U. nuda*), the writers carried out experiments in this direction. They obtained the following results:

1) Winter barley was entirely freed from *Pleospora trichostoma* by 3 hours' treatment with Kühn's ½ per cent. copper sulphate. The germination of the seed in the field was, however, diminished from 95.2 to 80 per cent.

2) The hot-water treatment was harmful to both winter and summer barley. On the other hand, intermittent hot water treatment was efficacious in the control of *Pleospora trichostoma*; this was of greater practical importance from the fact that both the smuts were destroyed at the same time, although the fact that the smut attack was not severe makes it impossible to give a safe opinion as to the efficacy of the remedy in the latter case. The treatment consists in putting a sack three-quarters full of barley for 3 hours into water at 40° C. (104° F.) and then for 10 minutes into water at 48° C. (118.4° F.) After the grain has been somewhat cooled by being put for one minute into water at about 40° C., it is left in the sack for two hours in a heated room and subsequently again immersed for 10 minutes in water at 48° C. Then it is spread out and quickly dried by repeated shovelling. As this process has an injurious effect on germination, 10 per cent. more seed should be sown than usual.

3) A combination of the hot-water and copper sulphate treatment destroys *Pleospora trichostoma* on winter barley, but is liable to do more injury to the germinating property of the grain.

4) Formaldehyde, which has been largely and successfully used in the control of bunt of wheat, had little effect on *Pleospora trichostoma* on summer barley.

5) Hot-air treatment in a thermostat considerably increased the severity of the attack of *Pleospora trichostoma*.

The observations made for the purpose of ascertaining how for the attack depended upon the time at which the barley was sown, showed that the temperature during the germination and growth of the young barley plant greatly influences the occurrence of the disease. Other reasons, however, make it undesirable to try and control the parasite by means of late sowing.

389 – **Experiments on the Control of *Urocystis occulta* (Wallr.) Rabenh. on Rye.** — Müller, H. C., and Molz, E. in *Deutsche Landwirtschaftliche Presse*, Year XI No. 13, p. 164 + 2 plates. Berlin. February 14. 1914.

The results of the pickling experiments carried out by the writers for the control of "stem-smut" of rye (*Urocystis occulta*) are given in the following table.

Treatment	Germination in artificial germinating bed after		Germination in the field %	*Urocystis occulta*: No. per plot
	5 days %	10 days %		
Untreated	82.5	86.0	73.2	234
Copper sulphate ½ %, 16 hours	82.0	86.5	73.4	0
» » » » 16 hours + subsequent 6 % lime treatment	79.0	82.0	77.6	0
Copper sulphate 3%, incrusted	79.0	84.0	78.8	0
Linseed oil soft soap 3 %, incrusted; then copper sulphate 3 %, incrusted	87.0	88.5	77.6	3
Copper sulphate 5 %, incrusted	69.0	84.5	64.6	0
Linseed oil soft soap 3 %, then copper sulphate 5 %, incrusted	76.1	87.5	72.6	0
Bordeaux mixture 2 %, incrusted	81.5	85.5	72.0	0
Linseed oil soft soap 3 %, then Bordeaux mixture 2 %, incrusted	86.5	89.5	75.0	7
Formaldehyde * ¼ %; 15 minutes	83.0	89.5	81.6	0
» » 30 »	79.5	87.0	72.0	0
Untreated	82.5	86.0	74.6	226
Formaldehyde ½ %, 15 minutes	84.5	87.0	62.2	3
» » 30 »	74.0	84.0	63.8	0
» ¾ % 15 »	64.0	79.0	46.6	1
» » 30 »	34.0	78.5	42.2	0
Soaking in: water at / and hot water at				
30° C., 4 hours / 50° C., 10 minutes	51.0	85.5	67.0	2
» » / 52° C., 5 »	63.5	84.5	78.4	0
» 6 hours / » 10 »	63.5	87.0	70.2	0
20° C., 15 » / 50° C., 10 »	42.5	79.0	74.0	0
» » » / 52° C., 5 »	6.5	41.5	34.4	3
» » » / » 10 »	0.0	26.0	9.8	0
Jensen method	82,0	85.0	78.8	3
Untreated	85.0	87.0	78.8	154
Sublimate 0.1 %, incrusted	87.0	90.0	77.4	3

* Using 40 % commercial formaldehyde.

From these figures, it is clearly seen that *Urocystis occulta* is very controlled by the well-known dip poisons, copper sulphate and formalde, and also by the hot water treatment.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS

390 – ***Ranunculus sceleratus*** (1) **and *R. Guilelmi-Jordani* as Weeds in Egypt.** — ROLLAND, B. G. C. in *The Agricultural Journal of Egypt*, Vol. III, Pa pp. 31-32, plates II-III. Cairo, 1913.

These two species of *Ranunculus* are considered noxious weeds in Eg *R. sceleratus* L. is a common plant by the sides of pools and wet ditc and is particularly common on the fresh Nile mud on both sides of the ri It flowers from April to January. *R. Guilelmi-Jordani* Aschers also gr by the side of pools and wet ditches and flowers during the same period

INSECT PESTS.

391 – **Entomological Pests and Problems of Southern Nigeria.** — PEACOCK, in *Bulletin of Entomological Research*, Vol. IV, Part 3, pp. 191-220, plates X XXVIII. London, 1913.

The writer gives an account of the results of a journey made in Sout Nigeria with the object of studying the economic conditions of the co in connection with the insect pests of cultivated plants.

INSECTS AFFECTING COTTON.

Cotton stainers. — Among the insects that injure cotton the mos teresting is the red cotton-stainer bug (*Dysdercus superstitiosus* This stainer is the worst pest of Southern Nigerian cotton, and doe immense amount of harm both to the seed and to the lint, by suc the juices of the former and staining the latter with yellow excretory ju The stained condition of the cotton in the native markets in the We Province, and especially the cotton gathered late in the season, is stril

The writer made some experiments to test the value of cotton and pressed cotton seed as bait for the purpose of enticing stainers, and catching them directly with traps or shaking the plants over a fu shaped collecting net. The best system hitherto adopted by the Su intendent of Agriculture, Ibadan, consists in gathering the cotton as soo it is ripe, sunning it well and constantly turning it over, which cause stainers to crawl away, when they may be collected and killed, thus d nishing the chances of further staining, and lastly burning the old co stalks.

The black cotton-stainer (*Oxycarenus dudgeoni* Dist.) is prob distributed throughout the whole Colony ; it also is very injurious to co because like the preceding s ainer it sucks the juices of the seeds ; it lay eggs in clusters at the base of the boll, securely protected by the lint sun and possible enemies. There seems to be a decided preference

(1) See also No. 187, *B.* Feb. 1914.

n species of *Hibiscus* as food plants, for some of these plants were at Ibadan to be black with these pests.

he measures suggested to control the red cotton bug apply equally ere.

oll-worms. — The larvae of *Diparopsis castanea* Hmp., *Earias biplaga* and *Chlorida obsoleta* F. bore into the unopened ripening cotton and r the seeds inside. The larvae leave one boll for another and ntly all the bolls on one plant are utterly spoilt. At the end of gII season the condition of the plants was found to be serious.

he treatment may be outlined as follows: For imported cottons, a l look-out should be kept for leaf-rollers and boll-worms during st and September. Immediately the presence of the insects is detected, eaves, bracts, bolls and buds in the affected area should be most ughly sprayed, more or less frequently according to the condition of ops as the season advances. At the end of the season all the old stalks the diseased bolls should be burnt.

is for native cottons, before they can be treated as suggested above, two es are open: 1) the obtaining by selection of a smaller native variety; topping and trimming of the plants and widening the distance be- the drills.

eaf-rolling caterpillars. — The larvae of *Sylepta derogata* F. and *nia phenice* Cram. cut and roll the leaves of cotton into the shape of ; in these shelters they feed on the inner rolls of the leaf. As many as terpillars of *Sylepta derogata* may flourish in one shelter, while *Ze- phenice* is usually solitary and is generally found where okra (*Hibiscus ntus*) is grown. *S. derogata* is extensively parasitized by a species aconid and a Tachinid fly.

he *green fly* (*Aphis gossypii* Glov.) — Its numbers are kept well in by natural enemies. Should the aphis show the least sign of increas- yond natural control, spraying with a resin wash is recommended.

he following insects have also been observed as injurious to cotton s: *Epilachna chrysomelina* F., *E. similis* Muls. var. *assimilis* Muls., *a villosa* F., and *L. viridipennis F.*, *Siderodactylus* sp., *Syagrus cal- is* F., *Plagiodera circumcincta* Sahlb., *Nisostra uniforma* Jac., *Ootheca ilis* Sahlb., *Euproctis* sp. and *E. lyonia* Swinh., *Pulvinaria jacksoni* t., *Ripersia* sp.

ome of the above insects are parasitized by Hymenoptera and Dip- ot yet determined.

he writer mentions a curious affection observed on the native Ishan deko cottons. The leaves become at first mottled with pale green or w spots, the undersides being densely and minutely pock-marked. ately the leaves shrivel and curl. The young leaves at the tip of the seem to be affected first, the older and larger leaves afterwards, till hole plant presents a most forlorn appearance. The cause of the se is probably physical, as no insect or mite was discovered. From nd of August to the end of October 1912 the trouble grew roughly 8 per cent. to 25 per cent. The percentage was arrived at by ob-

serving the same plants to the number of 1000 in the Ishan, and 1800 the Meko.

Cotton demands unceasing watchfulness and care from the t when it has two leaves, when attacks of grasshoppers, beetles and ca pillars may be detrimental to a good early strart; through the leaf grow period when leaf-rollers, caterpillars and aphis are at work; through all-important period of bud - and boll-formation, when boll-worms active; and up to the ripening and picking period, when stai are mischievous. The measures recommended will not be of any unless the pests are attacked with energy and general cooperation. difficulties of making cotton worth extensive exploitation are many: t are the inertia of the native towards clean farming; the difficult obtaining a good variety of native cotton which would fetch better pr and make it worth while expending labour and money in combating pe the difficulty of popularising even simple entomological methods; greatest of all the fact that cacao and rubber are more valuable than co and that the country is the land *par excellence* of the oil palm.

Even if a better native variety is produced, cotton will probably n be more than a useful native catch-crop.

INSECTS AFFECTING CACAO.

Cacao is attacked by leaf-eating caterpillars, among which is *Diac maculosa* Stoll., a species widely distributed throughout Africa; caterpillars are voracious feeders, like those of *Prodenia litura* F. w devour the leaves. From a larva of this species an Ichneumonid, *I pius discolor*, has been bred. Another species of *Diacrisia* and *Rhod campta forestosa* Cram. also feed on the leaves. The writer enumer many other insects found on cacao, but little is known as to their nomic significance.

The leaf-eating beetle, *Adoretus hirtellus* Castn., common in W Africa, feeds on the leaves of cacao, eating only the soft tissue. A describing some experiments made to control this pest, the writer adv clean farming and the segregation of cacao beds from maize, a comb tion of hand-collecting and spraying and maintaining unremitting wa fulness.

Another serious pest is the pod-borer, perhaps belonging to the ge *Myelois*, which is found in large numbers, up to 120, meshed in a raw silk among dry brown powder and riddled seeds, in cacao pods left han on the trees or lying on the ground. Judging from the thousands of pods thus left neglected at Agege on the native farms, the damage d must be incalculable. The larva of a Cerambycid, common at Agege, serious damage by boring in the trunk and branches; the adult is unkno

Catautops vittipes Lauss. (Locustidae) eats the leaves. *Ceratitis p tata* Wied., a species of *Monanthia*, *Pseudococcus virgatus* var. *madag riensis* Newst. and *P. citri* Risso (?) are also injurious.

he red tree-ants (*Oecophylla smaragdnia longinoda* Latr.) are not ul to the cacao trees, but owing to their numbers and their irritating hey are a great nuisance to the native collector when at work.
mong the beneficial insects the writer mentions *Metopius discolor* a *Sisyropa* which parasitizes the larvae of *Diacrisia maculosa* Stoll., ie following Carabidae which are probably useful in destroying harm-ects: *Oodes obesus* Murray, *Platynus planaticollis* Murray and *Chlae-estermanni* Laf., and some others of doubtful significance.

Insects Affecting Maize.

mong the insects injuring maize, *Cirphis ? phaea* Hmp. (« rami-rami ») in several localities in the Colony. Its larvae appear in swarms and leave a trace of grass or maize behind them. The maize replanted he visitation of the caterpillars does not stand a good chance of suc-g, because of weather conditions. The control of this pest demands ice; as soon as the young caterpillars are detected, burning the grass sh round the fields and lawns will destroy large numbers of them. illars which appear on the maize can only be prevented from doing ive damage by spraying. Other injurious insects are *Calamistes llens* Hmp. and *C. fusca* Hmp., the caterpillars of which bore into aize stems and frequent the flowers also, and Noctuid caterpillars ecies not yet determined; the latter bore into the seeds and destroy causing much injury; on account of their numbers, size and vora-ey are undoubtedly the worst maize pest. The beetles *Lagria villosa* d *L. viridipennis* F., and the locust *Zonocerus variegatus* L., are l leaf-eaters which also frequently damage maize.
1 order to free stored grain from *Calandra oryzae* L., *Tribolium eum* L., *Laemophloeus pusillus* Schön. and *Silvanus surinamensis* L., tives use very primitive and imperfect methods of disinfection (heat noke), and it is very difficult to popularise modern efficient methods igation.
nsects affecting Yams. — The following are mentioned by the wri-*Prionoryctes caniculus*, Arrow., *Crioceris livida* Dalm., *Apomecyna punctata* Chev., *Lagria villosa* F., *L. viridipennis* F. and *Zonocerus atus*.
nsects affecting Funtumia Rubber. —*Glyphodes ocellata* Hmp., *Nephele alens* Walk., *Thermopteryx elasticella* Hmp. and *Physothrips funtu-*Bagn.
nsects affecting Para Rubber. — Larvae and insects have been found into these plants.
nsects affecting Mahogany. — Mahogany trees (*Khaya senegalensis*) abar have suffered severely from the attacks of wood-boring lepidop-larvae, probably Cossidae, which bore holes into the trunk and hes. Another lepidopterous larva and a nocturnal cricket, possibly *ytrypes*, injure these trees.

Insects affecting Arabian Coffee. — The following insects were fo upon coffee: *Ootheca mutabilis* Sahlb., *Antestia variegata* Thumb., *Ri tus tenuicornis* Dall. and *Dictyopharina serena* Stål.

Insects affecting other plants. — *Rhynchophorus phoenicis* F., on oil palm; *Tennoschoita quadrimaculata* Gyl. and *Archon centaurus* Fa on coconut palm; *Adoretus hirtellus* Castn. on kola; *Cosmophila e Zebronia phenice, Dysdercus superstitiosus* and *Oxycarenus dudgeoni* on ((*Hibiscus esculentus*); *Lagria villosa* F., *L. viridipennis* F., *Monolepta Zonocerus variegatus* F., *Azazia irrorata* F. have been observed upon cowpea, and *Apate terrebrans* Pall. upon *Poinciana regia.*

392 – **Arsenite of Zinc as an Insecticide.** — SCHOENE, W. G. in *New York A tural Experiment Station, Technical Bulletin*, No. 28, pp. 1-16. Geneva, N. Y.

The writer gives the results of a series of experiments on the dete nation of the toxicity to insects of zinc arsenite and lead arsenate, and resistance of leaves to zinc arsenite. In this respect 1 lb. of arseni zinc is equivalent to 3 lbs. of arsenate of lead. The addition of slaked or Bordeaux mixture to the zinc arsenite prevents any damage to t foliage, but when it is used alone, or with lime-sulphur wash or gluco causes more or less spotting of the leaves. Arsenite of zinc, either alon mixed with glucose, causes severe scorching of the leaves of the vine. oratory experiments show that the damage caused by arsenite of zi partly due to its solubility in carbonic acid. The contradictory re obtained with this insecticide are presumably due to the lack of unifor in its manufacture. Arsenite of zinc and arsenate of lead mixed either Bordeaux mixture, soap or glue retain their activity for 25 d Applied alone or with glucose they gradually lose their poisonous prope on exposure to the weather, and at the end of 25 days cease to protect foliage. Lime-sulphur wash does not appear to resist moisture as we Bordeaux mixture.

393 – **Destruction of Locusts in Turkestan.** — *Communicated by* JOS. P. BAR *Commissioner in Russia for the French Ministry of Agriculture.*

From the earliest times, locusts have always been the most ser pests of agriculture in Central Asia; formerly the inhabitants, for relig reasons, did hardly anything to check their periodic invasions, but since conquest of Turkestan the Russians have paid considerable attention them, though it is only within the last few years that a methodical c paign against these dangerous enemies has been organized. If one co ders that Turkestan furnishes Russia with almost half the cotton use her mills (or about 120 000 tons), and that cotton suffered most f the repeated attacks of locusts, it will be readily understood that the R sian Government has every interest in ensuring the free development of important crop. Further, Turkestan is still almost without rapid me of communication, and consequently has to depend on its own produce of cereals, so that the protection of the cultivated land from the more less frequent attacks of locusts had become urgent.

The fauna of Turkestan includes a number of species of locusts, but they not all equally harmful. The first place is certainly taken by the Ma- locust (*Stauronotus maroccanus*), which prefers uncultivated arid plains ts egg-laying. The permanent area of distribution of this species com- s the steppes of Samarkhand, the Khanat of Bokhara, and Afghistan; it t rare to find important egg-laying centres in various parts of Turkes- but they cannot be considered as anything but temporary. The Ma- locust lays eggs up to nearly 2000 m. (6600 ft.) above sea-level; some- s the density of eggs reaches 10 000 clusters per square yard; each egg- g centre usually occupies some hundreds of acres, but may run into sands. In normal seasons hatching takes place between the 2nd and of April, lasting 7 to 10 days. The date and duration of hatching are, ever, much influenced by the altitude, the position of the centres, the erature and nature of the soil, and the rainfall. The larval period from 35 to 50 days, during which time the voracity of the insect con- ly increases. An idea of the enormous damaged caused by this species e crops in Turkestan may be had from the table given below.

The migratory locust (*Pachytylus migratorius*) possesses several per- ent areas of distribution in Central Asia, including the reed-beds along anks and in the deltas of the rivers Sir-Darya, Amu-Darya, Zarivachan, nd Tchou. This species rarely damages crops, preferring the shoots e reeds which occur in abundance near the egg-laying areas. At the time official data for 1896 speak of 75 000 acres of various crops dam- d by this species, possibly assisted by the nearly related *P. danicus*; cent years it has confined itself to uncultivated places, and no se- complaints as to damage done by it have been received.

The Italian locust (*Caloptenus italicus*) is a common species in Turkes- but till recently only caused insignificant damage. This appears to been due to considerable destruction by natural enemies. Recent rvations also show that it is almost always starved out by the more ious Marocco locust; an interesting fact is that in regions in which Marocco locusts were completely exterminated two or three years ago, *tenus* is now increasing to an alarming extent, and occurs in numbers lown before the disappearance of *Stauronotus*.

The following locusts are also known as injurious in Turkestan, though o the same extent as other species: *Oedalus nigrofasciatus* Deg., *Steto- a* (*Arcyptera* Serv.) *flavicosta* Fisch., *Arcyptera* (*Pallasiella* Kirby) *truch- a* Fisch-Waldh., *Acridium* (*Orthacanthracis* Karsch) *aegypticum* L., *Stau- us kraussi*, *S. tartarus*, *S. anatolicus* and *S. brevicollis*.

Destruction of locusts.

All the known means of destruction of locusts have been tried in Tur- n; the following is a brief summary of the work.

A) Mechanical means:

1) Collecting and destroying the egg-clusters was carried out on a scale for several years, but with next to no results, for the locusts

appeared in quantities at all the egg-laying centres and did enormous d age (amounting to nearly half a million sterling, according to the off figures). This laborious and irrational method has been defin abandoned.

2) Destruction of eggs by ploughing under has given no dec results.

3) Flooding of the eggs is a radical remedy, but unfortunate only applicable on continuous areas with a plentiful water supply.

4) Crushing the larvae by wooden or iron rollers made extra heav loads of earth stones, etc., and sometimes with thorny twigs drawn bel has been practised with success in some parts of Turkestan. It se however, to be a rather cumbersome method.

5) Collecting the larvae in sheets has hardly been practised, large scale except in the Ferghana region: it has been given up as not venient.

6) Catching the larvae in pits or ditches dug near the swarms c the way of moving columns of larvae has long been carried out in all of the country; pits are only used in the case of large swarms on a lim area. The destruction of columns of large locusts has also been attem by the use of barriers similar to those used in Cyprus and Durand's a ratus; the canvas was replaced by rolls of old sheet-iron 12 to 14 inches held up by short stakes. This is very effective, but is costly to put Ditches are excavated in the line of march of travelling columns of lo and are dug 2 to 3 ft. deep and the same in width, generally with ver sides; at intervals along the bottom holes are dug out 14 to 20 inches de for the larvae to collect in. Circular trenches may also be dug round dense egg areas before the larvae hatch out, but these are very expensive are not infrequently made useless by the destruction of the egg-cluste insects or fungi.

7) " Fishing " of locusts in streams and irrigation canals is prac when other means for stopping the moving columns have failed. Bu suitable watercourses rarely occur in the track of the columns, this me is of limited value, especially as the destruction is by no means perfect

8) Destroying the larvae by fire is carried out on a large scale in kestan. The method at present used is scorching by means of a special k sack apparatus; the petroleum flare of this can be turned on to the la in various directions with very little loss of heat. Several systems tried (Siédoff, Schkilin Bildin, etc)., and the Schkilin apparatus was fo to give the best flame. This method, however, comes rather expensive is only justifiable on irregular land free from grass and without stream other supply of water. Large machines on the same principle have also tried, but they have not given good results in practice.

B. CHEMICAL MEANS. — a) *Internal poisons.*

1) Spraying for locusts with Paris green has been tried on a large and has given excellent results. The best strengths have been found be: up to the 3rd moult of the larvae, 4lbs. Paris green and 8lbs. lim

gallons of water ; later 5 ¼ lbs. Paris green and 10 ½ lbs. lime to 100 ; and when the larvae are threatening the cultivated land the strength creased to 8 lbs. Paris green with 10 ½ lbs. lime. About 24 gallons pray are required to treat an acre. The total expense (apparatus, in- icide, labour, etc.) comes to about £ 3 3*s* 6*d* for a day's work, in which it 27 ½ acres would be treated, making about 2*s* 4*d* per acre. In spite ie cheapness of Paris green spraying, it has several drawbacks : the spray sily washed off by rain or dew, so that spraying may have to be repeated; n only be used where the ground is covered by vegetation ; the lime for ing the mixture may not be obtainable near at hand, and does not keep ; the Paris green does not affect the larvae till about the third day, so the effect cannot be ascertained at once, and washing off by rain may be noticed. The following table shows the area treated with Paris green he expense of the State) during the last few years, and the number rge machines used :

Year *	1902	1903	1904	1905	1907	1909	1910	1911
reated **, acres	121 259	137 084	147 023	93 335	11 342	8 308	124 442	196 710
green used, lbs.	148 390	191 410	198 640	106 710	19 254	13 885	195 860	286 840
large machines working .	110	136	136	141	48	30	238	104

No treatment in 1906 and 1908. — ** Treatment lasts 21 to 26 days per year.

To prevent the mixture being washed off by rain, an attempt has been e to use molasses instead of lime ; this has the further advantage of attractive to the locusts. The molasses is used in double the amount me, the Paris green remaining the same ; when molasses can be obtained ply, this mixture should be preferred, as it gives excellent results.

2) Ammonium arsenite, obtained by treating Paris green with am- a, has been tried in Turkestan at the suggestion of Schreiner (1911), whose ula is the following: Paris green, 1.2 lbs.; liquid ammonia at 22°, 1.8 lb.; n molasses, 10 lbs. ; water, 30 gallons. This mixture has some marked lvantages, not compensated for by its quick action and adhesive pro- es. Commercial ammonium arsenite has not been tried.

3) Barium chloride in 4 per cent. solution has given excellent results. insecticide is easy to prepare, is less dangerous for the men and does log the nozzles ; but it is much too dear, is easily washed off by rain, does not show up on the sprayed plants.

4) Sodium arsenite, long used in South Africa, was first tried in Turke- in 1911 ; it was so successful that it is now the only substance used large scale. The best strengths for the different stages of the larvae s follows : 1st and 2nd stages, 0.25 per cent; 3rd stage, 0.37-0.4 per ; 4th stage, 0.5 per cent. Perfect adhesiveness is obtained by adding le the amount of mollasses (brown sugar) in each case. Thus prepared, secticide is not readily washed off by rain and acts on the larvae in an ishing way : a mortality of 100 per cent. is obtained in the 24 hours ving the application. Sodium arsenite comes cheaper than Paris

green, gives a higher mortality, acts more quickly, sticks to the plants l
ter (used with molasses), and is easier to apply; on the other hand, it scor
the vegetation and is more dangerous to handle, but these sl
disadvantages are not enough to outweigh the advantages mentio

5) Other arsenical compounds, soluble and insoluble, tried in Tu
stan, have not given decisive results.

b) *Contact washes.* — These have also been tried, but without m
success; in particular soft soap solutions at 3.3 per cent. were recommen
by some entomologists, such as Rossikof and Schreiner; experiments
large scale have shown that they are not reliable. Contact washes pre
no advantage over scorching. Various other insecticides, like ordinary s
paraffin emulsion and certain complicated mixtures, have given no be
results.

c) *Hopper dodgers.* — These machines, successfully used in Ame
Australia and Russia, have been tried in Turkestan. They consist of l
plates of wood, sheet-iron or canvas, drawn by horses, and smeared with
troleum or bitumen; the larvae jumping out of the way fall onto t
plates and are caught by the sticky material. Hopper-dodgers are only
ful for the destruction of small colonies of locusts, as they do not c
enough to deal with the large invasions frequent in Turkestan. Furt
they can only be used in perfectly level places free from vegetation.

This study of all the methods tried on a large scale in Turkestan all
one to select the most convenient and advantageous for each partic
case. The Russian entomologists in charge of the work of destructio
this vast region at present use the plan detailed below; they have succeede
reducing the enormous damage caused by locusts to almost nothing. Tur
tan has been almost completely freed from these dangerous pests,
since 1911 the work has been largely confined to exterminating cer
centres of small importance which appear here and there near the front
of Persia and Afghanistan. The plan is as follows: 1) preparation in sum
and autumn of forecast maps, showing the position area and densit
the egg centres of each district; 2) treatment of the infested area with P
green, or better, molassed sodium arsenite, as soon as the larvae app
3) scorching by knapsack machines of larvae in places not accessibl
sprayers, devoid of vegetation or far from watercourses of sufficient c
cityto keep the sprayers going regularly; 4) capture of larvae in pit
ditches.

Natural Enemies of Locusts.

Among birds, the chief locust-destroyer in Turkestan is the rose-color
starling (*Pastor roseus*); these birds nest in the mountains and come do
in enormous flocks to follows the colums of larvae, as well as the flight
adults, which they often kill on the wing in large quantities. This speci
undoubtedly a precious ally, but in regions of organized control it ol
complicates the work; it would therefore be risky and unreasonable to
on regular assistance from these birds, and especially to include such an

stant element in the plans for destruction. The sparrow also hunts sts, and some writers believe that, like the pastor, it destroys the lar- simply for the pleasure of killing them. Ravens and crows take chiefly eggs, which they dig out of the ground in late summer and autumn; are made use of by the entomologists to discover the chief centres of laying for indication on the forecast maps. The destruction of eggs by rs is in some regions helped by certain species of lizards, of the genera *nias* and *Phrynocephalus*.

Entomophagous insects attacking locusts are few in number in Turkes- Among predatory ones may be mentioned certain species of *Calli-* s, which devour the larvae, and *Prosodes*, *Adesmia*, *Stalagmoptera* and ain Elaterids (? *Athous*), which feed on the egg-clusters. The true sites develop in the eggs, the larvae or the adults. It has been found species of locusts inhabiting districts with rich vegetation suffer more the attacks of parasites than those which pass several stages of their lopment in districts where vegetation is scanty.

The Marocco locust in Turkestan is attacked almost exclusively by phagous parasites, among which *Callostoma desertorum* is the most im- ant; then come its near ally *Mullio obscurus* F., and a Meloid, *Zonabris nctata*. The larvae bore into the egg-cases immediately after laying, undergo all their metamorphoses there. They are very numerous laces frequented by the locusts several years in succession; the larvae *allostoma* and *Mullio* alone may destroy 40 per cent. of the eggs, while e of *Zonabris* account for hardly 2 per cent.

The egg-clusters of the Marocco locust are also subject to attacks of ain fungi not yet properly studied; these may reduce considerably number of larvae hatching. The introduction of the fungi is evidently ted by the attacks of birds and is favoured by moisture in the soil; are so important that account has to be taken of them in drawing up plan of campaign: when the forecast maps are prepared, it is customary ote the degree of infection of the eggs by animal parasites, but the fungi so much alter the situation during the winter and in early spring, that res very rich in autumn may give no hatching in spring. Miscalculations his sort have not infrequently arisen, and in such cases parties sent to places at great expense were kept idly waiting for the eggs to hatch for ral weeks, when they might have been carrying out useful work in dis- s really in danger. For the forecast maps to provide reliable informa- , and thus to fulfil their purpose, it would be necessary to verify the state he eggs in the spring before hatching began and make careful notes of centres no longer dangerous; in this way much annoyance and use- expenditure would be avoided.

The importance of the natural enemies, in particular the endophagous sites, cannot be doubted; it is certainly to them that must be attributed almost complete disappearance of the locusts in certain years. But the e of this factor must not be exagerated in arranging the plan of destruc- , for the conditions of development of these organisms are as yet little erstood, and a large multiplication of them only takes place after re-

peated invasions of the locusts in a particular area. It is evident tha exigencies of modern agriculture are not compatible with such a sta affairs, for the simple reason that before the appearance of the para the crops will be devastated several times ; it is much more logical and to get rid of these dangerous enemies as soon as they appear than to coun the assistance of an element so vague and inconstant as the natural ene

Breeding of parasites on a large scale with a view to their utilizatio destroying locusts, has not been attempted in Turkestan. Last yea periments were made with *Coccobacillus Acridiorum* d'Hérelle; when ad istered after passage through locust hosts it gave a heavy mortality contaminated grass gave no decisive results. This method is still studied.

Economic Importance of Locusts in Turkestan.

We have already remarked on the special reasons for protecting crops in Turkestan from locusts. The figures given in the accompan table show the importance of the damage, the loss to the local popula the sums expended by the Locust Control Administration, and the re obtained.

Losses due to locusts in Turkestan.

Year	Area of egg-laying centres — acres	Area of crop destroyed — acres	Estimated value of crops destroyed — francs	Days of labour required for the control	Total loss to the population — francs	Expe for con — fra
1901	54 793	344 981	7 853 300	2 905 778	11 480 975	11
1902	184 668	259 060	5 895 000	5 054 789	12 217 350	50
1903	179 034	126 280	2 872 500	1 714 857	5 018 082	43
1904	259 426	59 238	1 348 437	1 470 276	3 186 280	41
1905	114 357	23 414	534 000	601 333	1 284 790	60
1906	42 543	0	0	0	0	4
1907	20 239	702	insignificant	0	insignificant	13
1908	25 428	4 112	106 125	419 295	811 080	2
1909	55 764	58 776	1 337 925	592 000	2 077 385	20
1910	226 233	8 451	217 375	391 175	706 342	1 19
1911	218 531	0	insignificant	0	insignificant	1 44
1912	0	0	0	0	0	?

394 – **Insects in Flour Mills and Granaries.** — Dean, George A. in *Kansas Agricultural College, Agricultural Experiment Station Bulletin*, No. 189, pp. 137 figs. 1-56. Manhattan, Kansas, 1913.

The writer describes numerous experiments on the cleansing of m from injurious insects by means of high temperatures, and discusses anot series of experiments on the destruction of insects infesting flour and sto

is by means of fumigation with hydrocyanic acid gas and carbon disul-
e. The damage caused by insects to stored grain in the U. S. A. amounts
per cent. of its value.
Lack of supervision and cleanliness are the causes of the large in-
e of insects in mills and granaries. It is very important to sweep up
ie waste flour from the floors, corners, under machines, etc. The appli-
n of high temperatures is the only efficacious and practical method
r known for destroying these insects. This method has developed to
an extent of recent years that it seems likely to revolutionise the com-
ively inefficient methods at present in use. The heating of various
in Kansas has given absolute proof that these insects cannot resist
eat in any of their stages, even in the most inaccessible places. This
n has also been employed with success in several mills in Ohio, Illi-
Nebraska, Iowa, Indiana, the south of Canada, etc. The heat pe-
tes throughout, through obstacles and into the remotest corners where
could not reach the insects. Many insects can resist the effects of
ocyanic acid for a long time, but none can resist a temperature of
o 122° F. for even a short time. Fumigation with hydrocyanic acid
res 2 or 3 days, thus involving considerable expense in the long clos-
f the mill and the cost of the necessary material, not to speak of the
er to the operators. If the heating system is applied from Saturday
nday morning no time is lost, the cost is small and there is no danger
e operators. In a mill which can be warmed to a temperature of 70° F.
nter, it is easy to obtain a temperature of 118 to 122° in summer. By
nethod no damage is done to the flour, the belting or machinery, and
is no danger of fire. It is recommended by the " Mutual Fire Preven-
Bureau ", which represents eight of the principal millers' assurance
anies.
Mills infested by *Ephestia kuehniella* Zell. (Mediterranean Flour Moth)
be effectively treated with hydrocyanic acid, but this method is not
mmended if the heating system can be applied.
The simplest, the most effective and the least costly remedy against
s infesting grains and their products stored in warehouses is careful
gation with carbon disulphide. In well closed buildings in which the
erature is about 70° F., 4 ½ lbs. of carbon disulphide is sufficient for
1000 cu. ft., and about 1 lb. for every ton of grain. It is not an effec-
disinfectant for flour mills, and for such places is not recommended
to the danger of fire.

The Florida Fern Caterpiller *(Eriopus floridensis)* in the United States. — CHITTENDEN, F. H. in *U. S. Department of Agriculture, Bureau of Entomology, Bulletin* No. 125, pp. 11, 1 fig. Washington, 1913.

During recent years a considerable number of caterpillars of *Eriopus censis* Guén. have appeared in the District of Columbia, in Illinois and nio. The insect is indigenous to Florida and Tropical America. It caused serious damage to ferns growing under glass.
The writer describes the life-history of the insect. The eggs and the larval stages have not been observed. The larvae feed chiefly dur-

ing the night, resting at the base of the plant during the day-time. T cause serious damage to ferns at all seasons of the year. The cocoons attached to fragments of leaves and other soil rubbish, near the leve the ground. The pupal stage lasts from 23 to 27 days.

Some of the natural enemies of the insect are *Ichneumon extren* Cress, *Sargaritis* sp. and a Tachnid not identified.

As means of controlling this insect, a decoction of hellebore, pois baits and carbon disulphide have given good results. Arsenate of would be effective, but it reduces the value of the plants by cove them with a white layer. The best method is hand picking the larvae w fall to the ground when the plants are shaken. Fumigation with hydrocy acid has not been much used, but should give effective results.

396 – **The Rose Slug-Caterpillar *(Euclea indetermina)* in the United Stat**
CHITTENDEN, F. H. — *U. S. Department of Agriculture, Bureau of Entomology, B* No. 124, 9 pp., 1 fig. Washington, 1913.

It is only within recent years that the slug-like caterpillar of *E indetermina* has been known to injure the rose. It has already been obse on plum, oak, chestnut, hiccory (*Carya*), pawpaw (*Asimina triloba*), bayb (*Myrica cerifera*), flowering dogwood (*Cornus florida*), apple pear, cherry (*Prunus* spp.).

All writers seem to agree in stating that the larvae mature during tember, but the specimens which were received from West Virginia had tured by August 20.

Eggs are deposited during July, in small groups slightly imbrea or overlapping, and hatch in about nine days. The larvae pass thr eight stages, and occasionally nine, before transforming to pupae, an has been observed that in stage I, which is passed rapidly, they tak nourishment. The species hibernates in its cocoon, and the moth generally been observed to issue in July.

In case only a few rose bushes or young trees are attacked, hand-pic is ample for controlling this insect, the precaution being taken to use a gl thus avoiding being " stung ". Should the caterpillars appear on se plants, they should be sprayed with Paris green or arsenate of lead.

397 – **Diptera injurious to Cabbages.** — SCHWARTZ, MARTIN in *Mitteilungen der schen Landwirtschafts-Gesellschaft*, Year XIX, Part 7, pp. 98-100, figs. 1-2. B February 14, 1914.

The writer refers to all the Diptera injurious to garden crops, and d specially with those attacking cabbages : *Chortophila brassicae, Anthon floralis, A. radicum, Phaonia trimaculata.*

For the control of *Chortophila brassicae*, chemical substances have yet given good results. The chief preventive measure is careful exam tion of the young plants before setting out and elimination of all show infection. A second examination should be made within a fortnight, all attacked plants should be destroyed ; before replanting, the vacant sp should be well beaten down and treated with insecticide, to destroy larvae in the ground. In this way the first generation can be got rid

Another important point is to burn the stalks after the cabbages are
Fresh manure should not be used. Seedlings grown in frames should
vered with netting to keep off the flies.

The Grape Leaf-Hopper *(Typhlocyba comes)* in New York State. —
LARTZELL, F. Z. in *New York Agricultural Experiment Station, Bulletin* No. 359,
p. 31-51, figs. 1-3, plates I-VI. Geneva, N. Y., 1913.

A large number of adults of *Typhlocyba comes* Say. survived the winter
11-12 and threatened many vineyards, but fortunately weather condi-
during the summer were unfavourable for the nymphs, causing a
ase of the insects during the late summer and autumn of 1912.

The most favourable hibernating places for the leaf-hopper are fence
woods, brush and waste land, weeds and places where leaves accu-
e. The drier, well-drained soils are more conducive to the safe
ring of the adults than the heavier soils. The foliage of raspberry,
berry, blackberry, currant, gooseberry, catnip (*Nepeta Cataria*),
ia creeper, burdock, beech and sugar maple is eaten by the hopper
it migrates to the foliage of the grape. The strawberry and raspberry
e favourite spring food-plants, the insect migrating from the straw-
to the raspberry during early May and from the raspberry to the
during the latter part of May.

lating of the hibernated adults takes place on the spring food-plants.
liage of the grape is injured by the overwintering adults, but most of
eding is restricted to the lower leaves, especially those of the young
or suckers at the base of the vine. The amount of injury to vineyards
directly with their proximity to favourable hibernating places and
food-plants.

praying experiments during 1912 showed that a solution of 1 part
er cent. nicotine (" Black leaf 40 ") in 1600 parts of water or Bordeaux
re is an efficient spray for the leaf-hopper. The fruit from vines pro-
from the leaf-hopper is superior to fruit from vines subjected to the
s of this pest. Chemical analyses of grapes from sprayed vines gave
of from 8 to 68 per cent. in sugar over those from untreated vines,
he unsprayed grapes had from 0 to 20.6 per cent. more acid than
d grapes.

he destruction of hibernating places of the grape leaf-hopper is recom-
d as a method of control, especially to save the young foliage of
ape in the spring. When hibernating adults are on the young foli-
laying the removal of the young shoots at the base of the vine will
o keep the insects on the lower leaves and thus afford some pro-
to the more permanent foliage. The lower shoots should be
ed just previous to spraying.

The Control of the Codling Moth in the Sacramento Valley, California. —
ODWORTH, C. W. in *University of California, College of Agriculture, Agricultural
eriment Station, Berkeley, Circular* No. 101. 4 pp., 3 figs. Berkeley, June 1913.

Contrast with the conditions prevailing in the Pajaro Valley, codling
appear in the Sacramento Valley early in spring and are ready to
gg-laying before the fall of the blossoms of the apple and pear. Egg

laying is concluded in about a month. The eggs hatch in about 8 ½ and the young larvae are abundant in the apples by the time they are as as peas; they remain in them for about 27 days. The pupal stage la month, and the moths are out by the middle or latter part of July.

A second generation occurs during August and September, and a of the more precocious are able to produce a third generation in the autu Usually the worms of the second generation go into hibernation as soo they have spun their cocoons and do not transform till the following sp

Most of the apples grown in the Sacramento Valley are early fruit, w is ready to harvest early enough to escape the attack of the second b of worms. Where nothing is done to protect the fruit the worms in two-thirds of the crops. If the orchard were isolated and all the frui moved at this time, the second generation might be largely annihilate starvation.

Pears are more largely grown in the Sacramento Valley than apples, are not usually seriously affected by the first brood of worms (less tha per cent.), but if not controlled the worms of the second generation inj third of the crop. The usual method of harvesting pears removes the l proportion of the worms of this second generation from the orchard; h the relatively small injury from the first generation of the following year

The gathering and destruction of fallen fruit was formerly require law in California. Twenty years ago the placing of bands of old grain s round the trunk and examining them once a week or once a fortnight found more effective. A parasitic wasp imported from Spain was f to be of no practical value.

The use of arsenical poisons has come to be the sole me for the control of this insect. All who have investigated the subject a that the poison must be applied before the worms enter the fruit, a thorough application is necessary for the best results. Both the life tory and observations of the results of practical spraying work indi that the time for the first application in that valley is as soon as pos after the petals fall.

In the case of pears or autumn apples, unless this first spraying been very thorough, the second brood will require attention during latter part of July or early in August. For this purpose the placing of ban sacking about a few of the trees is recommended, and these should be mined about the 1st and 15th of July and August.

One thorough spraying for summer apples and one or two for aut apples and pears will completely control the codling moth in the Sacram Valley. The writer gives the following formula for an orchard of abo acre of average-sized trees:

Lead arsenate.	3-6 lbs.
Water.	100 gallons.

Zinc arsenite may be substituted for arsenate of lead, using about third as much (1-2 lbs. for 100 galls. of water), or Paris green (½-1½

galls). In the latter case it is usual to add about three times as much e. This serves two purposes, holding the arsenical poison on the tree marking the tree so that one can be sure of the thoroughness of the ap- ation.

- **Small Ermine Moths (*Hyponomeuta malinella* and *H. padella*) in the United States.** — SCHOENE, W. J. and PARROT, P. J. in *New York Agricultural Experiment Station, Technical Bulletin*, No 24, 40 pp., 10 figs, map, 9 plates. Geneva, N. Y., 1913.

Hyponomeuta malinella and *H. padella* were found in numbers in the te of New York in 1909, probably imported on infected stock. They now found in many districts, *H. malinella* on apples and *H. padella* on tethorn and plums.

In the Unites States the moths appear in the first fortnight of July, egg-laying begins about the middle of the month. The larvae, after rnation, feed till the second half of June, and then pupate.

These species seem to be largely free from the numerous parasites which ck them in Europe ; but an Ichneumonid (*Mesochorus* sp.) has been bred *H. padella* on cherry, while a Tachinid (*Exorista arvicola* Meigen) has found abundant in some colonies of *H. malinella*.

The chief means of control are careful inspection of nursery stock in e, and arsenical spraying.

ALFREDO RUGGERI, *gerente responsabile.*